DOCUMENT RESUME

ED 048 484 VT 012 665

AUTHOR	DeVore, Paul W., Ed.; Smith, Wil J., Ed.
TITLE	Education in a Technological Society.
INSTITUTION	West Virginia Univ., Morgantown.
PUB DATE	Dec 70
NOTE	102p.; Papers presented at the Conference on Education in a Technological Society (West Virginia Univ., May 4-6, 1969)
AVAILABLE FROM	Office of Research and Development, Appalachian Center, West Virginia University, Morgantown, West Virginia 26506 (single copies available)
EDRS PRICE	EDRS Price MF-$0.65 HC-$6.58
DESCRIPTORS	*Adjustment (to Environment), Citizen Participation, Citizen Role, Conference Reports, *Educational Needs, *Educational Responsibility, Human Resources, *School Role, *Technological Advancement

ABSTRACT

Technological change places increased responsibility on the educational system of a democratic society to prepare citizens for intelligent participation in government. This conference was held to analyze the nature of the technological society and the role of education in preparing the individual for membership in that society. The papers presented include: (1) "Technology and Social Purpose" by Juergen Schmandt, (2) "The Future of Man in a Technological Society" by James H. Straubel, (3) "Technology and Change: Educational Imperatives--Technology is Our Own Thing" by Daniel V. DeSimone, (4) "Technology, Education and Society" by Walter Lowen, and (5) "Education, Technology and Human Values" by Edward Layton. (BH)

ED0 48484

EDUCATION IN A TECHNOLOGICAL SOCIETY

Edited by
Paul W. DeVore
Wil J. Smith

Office of Research and Development
Appalachian Center
West Virginia University
Morgantown

VT012665

This conference was partially supported by a grant from Title I of the Higher Education Act of 1965.

ED0 48484

EDUCATION IN A TECHNOLOGICAL SOCIETY

Edited by

Paul W. DeVore

Wil J. Smith

Office of Research and Development

Appalachian Center

West Virginia University

Morgantown

December 1970

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

PREFACE

The papers included in this publication are the proceedings of the *Education in a Technological Society* conference held at West Virginia University, May 4-6, 1969. This conference, co-sponsored by the College of Human Resources and Education and the Office of Research and Development of the Appalachian Center, was one of several critical issues conferences conducted by West Virginia University in 1969.

One dimension of the multidimensional educational crisis is related to technology. The educational system has failed apparently to prepare individuals for maximum flexibility and maximum adaptability. Many people have failed to achieve maximum self-realization and are quite unhappy and disillusioned as they view their own apparent insignificance in shaping the worlds of today and tomorrow.

The purpose of the conference was not to publicize the latest technological breakthroughs and their implications for increased productivity in a goods-oriented society. Rather, it was a human resources oriented conference which sought to critically analyze the current status (condition) of man in a highly technological world and the future of man in an increasingly technological society given several alternative strategies for our educational institutions. The paramount goal of the conference was to view the human, social and economic facets of the technological revolution and to determine the role of education in preparing the individual to become an effective, eager participant in the process of benign change. The critical question asked was how can educational insitutions become "part of the solution rather than part of the problem" of technological society?

The unique and significant feature of this conference was the use of task groups composed largely of key, selected representatives from almost every discipline at West Virginia University. Much of the success of the conference can be attributed to the hard work of these

task groups and their chairmen. A summary of their discussions is included in this report.

The contributions of Dr. Alice Mary Hilton, Dr. Billy Coffindaffer, and Dr. Jay Barton deserve special mention at this point. Dr. Hilton chaired each session of the conference in addition to participating in the task group discussions and summarizing the work of the task groups. The stimulating and enthusiastic welcoming remarks of Dr. Coffindaffer, Dean of the Appalachian Center of West Virginia University, and the energetic participation of Dr. Jay Barton, Provost for Instruction at West Virginia University, for the duration of the conference provided the visible University administration support so necessary for a successful conference.

We feel we were fortunate in obtaining an excellent group of principal speakers for this conference. We feel certain that you will find their papers and the other proceedings of this conference both challenging and informative.

Wil J. Smith
Office of Research and Development
Appalachian Center

FOREWORD

A democratic society, by definition, requires the intelligent participation of its citizens in the affairs of government. Today, however, the principle of "one man, one vote" is in danger of being obviated because of the developing phenomena called technology and the widening "gap" in society between those who know about, understand and can perform effectively in a technological environment and those who cannot.

More and more the major questions of the day are technologically oriented or closely related to technological developments.

In view of this a conference on *Education in a Technological Society* was held at West Virginia University to explore the educational needs of citizens for the present and the future and the role of the public schools and universities in meeting these needs.

The public schools and universities, with few exceptions, are not addressing themselves to the questions. The public schools continue to empahsize an academic model for the preparation of youth for college and the colleges and universities are concerned with specialized and vocational preparation for the world of business, industry or the professions.

Neither segment of education has successfully addressed itself to the human, social, economic and technological issues and related competencies required for intelligent citizenship.

The issue is diverse and complex. To the casual observer, educator and lay person as well, a problem does not exist. If it does exist, the usual answer is to apply solutions developed for the mechanical era of technology which fall far short of the needs for a totally different age; an age of automation, cybernetics, and an intellectual technology.

That there is a problem can be attested by the great turmoil, confusion and even withdrawal from the issues by many in our society. It has been said that what we do not understand, we fear or reject.

At a time in history when the capabilities are available for man to live the most human existence ever, we find great masses resisting

change and opting for the past, a past to which it is not possible to return. We find concern about future roles, choices and the ability to adjust to the evolving society.

We also discover that man may be on the verge of losing control of the technology he has created. The ecology is in precarious balance. Yet, few citizens raise the issue because their education has not prepared them to cope with change, to think in terms of systems, interrelationships or symbiosis. Compartmentalization rather than synthesis is the mode.

These are the issues evident today. They are the issues which education must face if the institution of education is to serve its function in society for all citizens. It is a question of education in a society in transition.

The conference addressed itself to the critical question: What is the role of education in a technological society? The primary objectives of the conference were to:

1. Identify the basic assumptions in relation to man, society, culture, values and education in a technological society.
2. Determine the characteristics of a technological society.
3. List and describe the characteristics of a technological society which have implications for general education, i.e., the education of all youth.
4. Determine the interrelationships of a democratic form of government, a technological society and education with respect to: What should be taught?, When should it be taught?. and How should it be taught?
5. List and describe the competencies required by citizens to function effectively in a democratic society which is at a high level of technological development and identify and briefly describe the categories of technological knowledge and skill required by all citizens.
6. Identify the curricular implications of the advancing technological society for:
   (a) Higher Education
   (b) The Public Schools
   (c) The Preparation of Teachers
   (d) Other Educational Agencies and Enterprises
7. Provide recommendations for policies required to implement the findings of the conference.

The editors feel these objectives were accomplished and that you will find a careful reading of the papers to be very provocative, informative and worthwhile.

Paul W. DeVore
Conference Director

TABLE OF CONTENTS

PAGE

PREFACE. iii

FOREWORD v

CHAPTER 1
TECHNOLOGY AND SOCIAL PURPOSE 1
Juergen Schmandt
Discussion Summary 16

CHAPTER 2
THE FUTURE OF MAN IN A TECHNOLOGICAL SOCIETY 18
James H. Straubel
Discussion Summary 24

CHAPTER 3
TECHNOLOGY AND CHANGE: EDUCATIONAL IMPERATIVES–"TECHNOLOGY IS OUR OWN THING". 28
Daniel V. DeSimone
Discussion Summary 32

CHAPTER 4
TECHNOLOGY, EDUCATION AND SOCIETY 35
Water Lowen

CHAPTER 5
EDUCATION, TECHNOLOGY AND HUMAN VALUES 46
Edward Layton
Discussion Summary 62

CHAPTER 6
SUMMARY OF TASK GROUP DISCUSSIONS 65
Task Group III – Raymond M. Haas 65
Task Group III – George Weaver 69
Task Group III – Emil Steinhardt 72

8

CHAPTER 7
SUMMARY OF THE CONFERENCE 75
Alice Mary Hilton

CHAPTER 8
CONFERENCE ANALYSIS 83
Wil J. Smith

APPENDICES
Appendix A 91
Appendix B 94

TECHNOLOGY AND SOCIAL PURPOSE

Juergen Schmandt*

That technology shapes our world, that it makes possible our very existence—these are obvious truths, almost commonplace. But they help to remind us of the close relationship which exists between man and technology: Technology is man's ingenious invention for expanding himself beyond the limited powers of his own organs—arms and feet, eyes and ears, muscle power and brain power—, providing him with the tools necessary for mastering the world. This invention has marked human history from the very beginning: the story of man and that of human progress are intimately linked to the story of technology. Man is a technological being. Technology is a necessary condition of human progress.

I realize that this proposition is being questioned on occasion. I am not going to do so. Instead, we shall ask: Assuming a close link between technology and social progress, and also assuming that this link is not easy to establish, what are some of the specific social conditions for strengthening this link, and what are some of the specific social conditions working in the opposite direction? In other words, under what conditions does technology lead to social progress, and under what conditions is this not the case?

My hypothesis is that, as a society, we have not yet learned, in a number of important areas that are of concern to us all, to establish a benficial link between technology and social purpose. Why is this so? What is the nature of this gap between the power of our tools and the uses we put them to? How dangerous are its effects, and can it be bridged? We shall also ask—and this will be our first step—what do some of the prominent critics of technology tell us about the gap between technology and social purpose?

*Associate Director, Program on Technology and Society, Harvard University.

There are many, indeed, to whom technology is of questionable value. This is not a new phenomenon. All during the period of industrialization–if we limit our attention to the two centuries of the most spectacular growth of technology–an endless number of pamphlets, articles and books was written on the dangers of machines, how they enslaved man and led him away from his real destination. This literature was, in general, more influential in Europe than in America, which in the 19th Century was seen by many European observers as the prototype of a technological society with a corresponding "pragmatic" or–as they readily concluded–"materialistic" value orientation.

Basically, the critics were made up of two groups: First, the anti-technologists who saw technology as a devilish instrument capable of destroying the original unity between man and nature. Their solution, consequently, was a return to simple, intimate, traditional, rural or small town life-styles and values. The acceptable, "good" technology was that of the blacksmith and the carriage maker, or that of the age-old mining profession. This was the romanticist opposition to industrialization and urbanization. Its membership was made up of poets, political conservatives, the orthodox of all denominations, and–of particular historical importance–some of the intellectual forefathers of fascism and nazism.

The second group saw in technology an important new production force, the engine of change and progress, but was convinced that change came so fast and in such ways that it posed severe problems for man and his dignity. Charlie Chaplin's *Modern Times* is a classic illustration of the nightmare which technology brought for the assembly line worker. What was at fault for this group of critics was not technology as such but the way in which it was socially organized. The moderates in this group sought to improve working conditions of the laborers by better pay, shorter working hours, workers' insurance and pension plans, pleasant factory buildings, in-house training programs for those who wanted to advance in their careers. The radical critics–the early socialists and later the communists–fought for taking away control and ownership

of the means of production from private entrepreneurs and demanded policy measures ranging from nationalization of individual enterprises or of key sections of industry to a complete take-over of the economic system by the State.

Thus the criticism of technology was aimed in one of two directions: either technology as such was assailed because it enslaved man (the romanticist critique), or the social mechanisms for the control and utilization of technology were condemned as a principal cause of social injustice (the socialist critique).

Today this two-pronged critique of technology is at a high peak on both sides of the Atlantic. Again the critics range from conservatives to followers of the New Left. Among the best known critics we find Jacques Ellul, an often-quoted and less often read French anti-technologist who teaches at the law faculty of Bordeaux and is an active lay theologian; Lewis Mumford, the cultural historian for whom the wall-enclosed medieval city represents the golden age of urban development; and Herbert Marcuse, the one-time existentialist philosopher and chief idealogist, for several years, of the New Left. Marcuse, in particular, has been instrumental in spreading an outspoken negative view of technology among large segments of the student population. For many of the young people today, technology brings only more of what we already have in abundance (and easily take for granted): economic affluence, military might, superiority in space and a cold attitude of rationality and cost-benefit calculation which determines the climate of our society. In their veiw technology offers little for creating a qualitatively better, a more humane society, a society with less injustice, fewer depraved people and disadvantaged minority groups, more individual participation. Hippies as well as radical students share the dream of a world no longer dominated by power and hardship, but permeated by love and sympathy.

Let us pause briefly and ask what are some of the specific grievances that are being raised against technology. It is seen as threatening or even destroying the jobs, political rights, traditional life styles and ethical values of people. Automation, as the latest form of mechanizing the production process, is seen as bringing

large-scale unemployment. The work that cannot be taken over by machines will be frustrating and dehumanizing. Electronic surveillance techniques, new methods of behavioral control, and computerized data banks increasingly invade man's privacy and make the independent citizen of yesteryear an impersonal entry in a computer system. Government becomes ever more powerful and its actions ever more technical. Direct participation by the individual citizen in political decisions becomes impossible or is reduced to a formality. The real decisions are made—*de facto,* though not yet *de jure*—by technical experts who are not democratically legitimized, by men to whom the rights and aspirations of the individual mean little and the rationality and efficiency of the systems means everything. Technology, to function reliably, needs fast and precise communications among people; it sees little importance in those human interactions which are not rational, but affectionate, emotional or, at the other extreme, governed by hatred and violence. Technology directly challenges the value system in which these personal and group relations traditionally found their normative regulation and myths, religion and art which gave them symbolic expression. In short, man becomes enslaved by the tools which he created for his own liberation from misery and hardship. He has gained what is now seen as secondary freedoms—freedom from hunger, cold, and, at least partially, disease—and has lost his political, ethical, and spiritual freedom.

That all this is so, is not seen, obviously, by those in power. The political and military leaders are awed by the miraculous power of science and technology and look at them as if they were fetishes. The industrial manager sees in technology an ever ready instrument for stimulating new consumer wants which he will then set out to satisfy, so that his company may prosper and grow bigger and bigger. The educated middle-class suburbanite enjoys his a-political consumer status. The scientists and engineers find that they are, somewhat to their own surprise, influential members of the new elite. All these groups together—the Establishment—go on happily committing huge financial and human resources to science and technology. Seeing only their own direct interest they unwittingly

nurture an insatiable Moloch who has long evaded human control and grows according to his own autonomous logic. It is he who dictates the shape of our society and the direction in which we go. He carries in himself the power to destroy man and his world—be it in one major world catastrophy or in the slower but equally effective erosion process that undermines individuality and democracy.

I have tried to evoke some of the tone and content of the contemporary criticism of technology. I do not propose to comment in detail on its underlying ideological assumptions, value judgments and political aspirations. Suffice it to say that this critique is persuasive and appealing, in one way or another, to a surprisingly large number of people, and that it can point to some factual evidence to support many of its assertions (which is probably true of almost any assertion one can make). Everything considered, I don't think that it does much more than to knit together a number of half-truths. It offers no realistic solutions. Exactly as in the past, we are offered either an anachronistic, anti-technological search for the lost paradise or the vague utopia of a New Science and New Technology which would no longer be based on the combination of rationality and social oppression which is seen as characteristic of our technology, but on instantaneous communication and friendly interaction with nature as well as with fellow men and the search for a symbolic expression of this interaction. Marcuse refers on occasion to such an alternative of a fundamentally different science—different in methods, products and objectives. He does so when he argues that today's science is the expression of a specific historical period and that other forms of science for new periods of history are possible. Marcuse does not really say much about this new mystical science. This in itself may be an indication that he is not convinced that such a science could be developed.

Whatever we may think about the possibility of developing a *New Science,* we should not leave Marcuse without noting that he raises an important question about the role of science in our society: science became great by refusing to look at the social consequences of its work. This courageous attitude made it possible for science to become free from outside interference by church and

state. However, now that science has become a major recipient of national resources and is capable of producing atomic bombs or of changing man's biological heredity it becomes a serious question if this absolute freedom of research and the researcher is socially acceptable. At present, we just begin to see this as a problem and so far we have not gone far in the effort to develop new mechanisms for "resocializing" science. Should we do this in the West it might destroy—this we have to admit—some of what has made science great.

Marcuse points to a real problem here, but because of his ideological position he is not really talking about science but a new form of mysticism. In most of his more sober statements, however, he limits himself to the old socialist critique of technology according to which science and technology are important productive forces which are used, unfortunately, in dangerous ways, both in capitalist and in communist societies.

We have to conclude that the modern versions of the romantic and the socialist critique of technology do not contribute much to a better understanding of the many social problems that come along or are closely associated with technological change. Both approaches are committed to particular ideological positions. To prove the truth of those ideologies is their essential interest, not to improve our understanding of how technological change leads to social change and what kinds of problems, dislocations, or crises are typical of this process.

It seems that we have to start all over again. I started, as you may remember, with the ackowledgment of tensions and unresolved social problems that come along with technological change. To come to a more balanced understanding of why this is so and what might be needed in order to narrow the gap between technology and social purpose it will be necessary to look more closely at some of the problems that technology poses for us. In doing so I shall group the problems in six general categories. (I am not aiming for an exhaustive list, but just as giving some representative examples.)

(1) *New policy issues:*

Our social mechanisms find themselves faced with new tasks which follow directly from the immense power which is characteristic of some technologies. The catalogue of tasks to which the policy has to address itself has become larger. Nuclear energy, to take the best known example, gives us the power to virtually blow up our planet, a power no society ever had in the past. This changes completely the structuring of international relations and our thinking about war as the ultimate recourse for settling differences between nations. The maintenance of peace, at least among the big powers, requires new approaches and new mechanisms, as evidenced in embryonic form by the Washington-Moscow hot line as well as the various negotiated agreements to limit the possession of nuclear weapons and the experiments undertaken to develop them. In this same category of problems we might think of a completely different case, that of television. We talk much about this medium's role in instilling a taste for violence in our children. This we might expect to change by better public control of TV programs. But what about TV's more subtle but ever present impact on the education of the young? Do they learn and think differently than children did in pre-TV days? Are they confronted with adult problems prematurely and in ways which make it difficult for them to acquire their own experiences at their own pace? What does this imply for the ways in which parents, schools, and churches educate children?

(2) *Deliberate decisions against developing certain technological feasibilities:*

A second problem area has to do with uses of technology which, by the overwhelming judgment of the experts, would have such dangerous effects that society would be well advised in not developing them at all. One example was the proposal, advanced several years ago, to "nightlight" the battlefield in Vietnam by means of reflected sunlight. The possible large effect of this human intervention in nature on world-wide communications was sufficient reason for shelving this ingenious idea. Another proposal, seriously discussed by distinguished scientists, attempts to bring a

technological solution to the ever more difficult direct participation of citizens in reaching important political decisions. The idea is to install a computerized instant voting system which would permit every citizen to express himself on important issues and to have the results available almost instantaneously. Technically it should not be overly difficult to install such a system, but only a moment's reflection reveals that this might mean the end of representative democracy with its built-in delays which are not just the vestiges of previous, less efficient transporation and communication technologies but healthy and wise opportunities for reflection, debate, and reconsideration of controversial issues.

(3) *Social and economic dislocations:*

In the third group I list the dislocation and adjustment problems which are forced on us with the introduction of new technologies. These are very real and difficult-to-solve problems, in particular from the point of view of those who for no apparent fault of their own lose jobs or can no longer compete in the labor market with skills which suddenly have become obsolete. Economic and social history tells us of wave after wave of new technologies which bring about new industries and new occupations and simultaneously the decline of old industries and unemployment for their workers. This kind of change, be it the introduction of the spinning jenny in the past or of computers today, is a major cause of social unrest. And quite understandably so, since it is only human that the institutions and professions built around an old technology will resist the change and claim that they represent a more desirable social order and higher or better values. Sometimes the fear of a new technology becomes a factor almost independent of its real social and economic impact. The automation debate of recent years was a perfect example of an overreaction, based on fear and insufficient knowledge, on the part of workers and unions, journalists and social critics of the introduction of a new technology. At the time, a major social crisis seemed to be just around the corner. So far it has not materialized, partly because in an expanding economy other industries can provide employment for those who lost jobs, and partly

because the new technology took much more time than expected before it was widely introduced.

(4) *Control of negative side-effects:*

The fourth group has to do with the many negative side effects of technology. While some of which might have been foreseen, others were clearly beyond the scope of our imagination and knowledge at the time we introduced the new technology. Think for example of overpopulation and world food shortage as side effects of dramatic improvements in health care. Or of the upsetting of the balance of nature due to the wide-spread use of highly effective insecticides. Many of the nuisance effects of technology also fall in this group. It was visible that a single steel plant polluted air and water when the plant first started production. (Even though people may not have reacted this way at all at a time when fuming chimneys were an object of communal pride.) But who could possibly have imagined the combined effects of thousands of smokestacks and millions of automobile exhaust pipes?

(5) *The systems effect:*

Here we deal with social problems resulting from the interaction of a variety of technologies. We might call this the systems effect of technology. When a variety of technologies, all of them highly sophisticated by themselves, combine their effects and jointly form an interdependent system we are faced with new and highly complex social and political issues. The most outstanding example is the densely populated large metropolitan area. Many technologies contribute to its viability–transportation, communications, construction, energy distribution, production of goods and services. We find to our dismay that we may be superbly efficient in developing the individual technologies and at the same time incapable of satisfactorily controlling and developing the urban systems as a whole. Another example of our difficulties in mastering the complexities of a system whose constituent elements are complex and have an increasingly high technological content can be observed in

the often assailed trend to turn over important political or strategic decisions to experts, a process by which democratic controls and citizen participation are endangered.

(6) *Unmet social needs:*

Our last and most general group has to do with our apparent difficulties in making better use of technology in order to solve a number of social problems which plague our society. Most of us agree that our educational system is in deep trouble. We find it increasingly difficult, it seems, to provide high quality and diversified education to a growing and more demanding student population or to create a successful large-scale program for adult education—needs that seem so obvious for a technological work force. Why is it that educational technology, though often praised as being ready for revolutionizing education, as yet has had little to offer to improve education? Why is it that a sober look at the institutional environment of schools and the current state of educational technology comes to the conclusion that the next decade can hardly be expected to bring a significant change in this situation? Or another question: why do we make so little progress in integrating the minority groups into a steadily expanding economy? Will we have to wait until blacks and the rural poor, out of their own initiative, have attained higher educational standards before they can join the work force of a technological society?

These, then, seem to be some major problems that technology brings to an advanced industrial society: (1) the need to restructure its social mechanisms to control and orient the power of technology, (2) the need for political decisions against the development of particularly dangerous technologies, (3) the task of alleviating technology-induced dislocations and of educating people to live with change, (4) the creation of mechanisms capable of reducing negative side effects of technology and of taking such action before the crisis is upon us, (5) the development of new knowledge and institutions for guiding complex social systems which for their very existence and survival are dependent on the interaction of a variety of highly sophisticated technologies, (6) the search for social incentives and

institutional mechanisms which would apply the problem-solving power of technology to the solution of unmet social needs.

This is a formidable agenda for action. It is even more impressive when we add to it the requirement that all these tasks should be met without unduly endangering basic principles on which our society is built: the rights of the individual, the processes of democratic government and the pluralism of institutions.

It seems to me that there is one common theme which ties together all six points on the agenda for action. It is best expressed in the form of a hypothesis: if we are serious in our desire to master the social and political problems of our technological age we have to supplement the attention given to the growth of science and technology—a task which we have been doing well for quite some time—by more attention, thought and action to the creation of new social and political institutions which are appropriate to the conditions of our age. These institutions, and the decisions they will have to make will be different from those that we now have. But given sufficient understanding of the problems that we are faced with and a strong commitment for solving them, they will not, as the radical critics assume, be the typical institutions of a technocratic and dehumanized society.

However, we should not underestimate the difficulty of the task which lies ahead. Faithfully waiting for new solutions that science and technology will come up with will no longer do. Indeed, this attitude may be responsible, to some extent, for our failure in several areas in taking required political decisions. We behave quite often as if we had to face this alternative: either make an unpopular **political** decision or wait for a new **technological** development which will almost automatically solve our problem or make it obsolete. The very success of technology is the solid base on which this optimistic faith is built. It is an attitude which understandably is often characteristic of scientists and engineers. Their numbers are growing, as is their influence in our society. Increasingly, we find the same unshakable trust in scientific analysis and technological solutions for political issues among politicians. In the past we used to deplore the politician's ignorance and lack of interest of science. Today we often

find this changed to uncritical awe of science and the belief that complex and controversial social problems can be reduced to relatively simple, quantitative elements. It is difficult to say what is more dangerous: uncritical glorification or ignorant neglect of science and technology on the part of the political decision-makers.

There are some hopeful signs, however. We begin to view more critically the plan, put forward over and over again only a few years ago, that the ghettoes would disappear and the city crisis would be solved almost overnight if only we could bring to the solution of those tasks the methods and the men who were so successful in building weapons systems and spacecrafts. Systems analysis and other advanced planning methods are important tools for preparing certain decisions relative to the development of urban systems and other social issues. But it is clear that these methods or the experience gained with the nation's space program, are no models for large scale solutions of social problems. Once the initial political decision was made—with the help of the Russians—to go ahead with a major space program, technical factors became dominant to an extent that is neither feasible nor desirable in urban or regional development or in assisting the changing economic systems of Latin America or African countries. There are severe limitations to the direct technical solution of social problems.

The attempt to reduce social issues to technical problems is not a promising strategy for us. No more so than the solutions that we had examined first: the reactionary "No" to technological progress, the search for a New Technology or the taking away of technology from those who now control it by means of a revolutionary overthrow of our economic and political system.

What then is a viable strategy? There is no simple answer to this question. This will not surprise you. What seems needed, in the first instance, is improved understanding of how technolgical change leads to social change, why it necessarily—not accidentally—leads to tensions and what kind of actions are required, on the part of individuals as well as of social institutions, in order to alleviate tensions and adjust to changed conditions. Our knowledge in this area is primitive and unsystematic. This we have to admit. Perhaps

we are at a point now where economics found itself before John Maynard Keynes. Probably the analogy is still too optimistic and we have yet to wait for our Adam Smith. Also, who knows if Keynes' new analysis of economic processes would ever have become guidelines for government policy had it not been for the traumatic experience of the crash in 1929? We can only hope that improved methods for socializing technology will not have to wait until after a major crisis—bigger even than those that we are faced with right now—has occurred.

Let me make a few, rather simple statements which to me seem to give us something to work on in our effort to improve understanding of the technology-society relationship. These are clearly preliminary statements. You will notice, I hope, that they come as conclusions to some to the things that I have been talking about today.

First, it is by necessity that technological change leads to social and institutional change. Technological innovation is just the first step in a long chain of innovations. The first step, to be sure, is important, but it amounts to little if it is not followed by social innovation. Each major new technology, to be successful, has to build around itself new institutions (factories or public agencies), new skills, new occupations, new working patterns. If this kind of social innovation does not take place the technological innovation is abortive. To this extent we have to say that social development is determined by technological change. But clearly there are different forms which social innovation can take: we can organize a state monopoly to develop a technology, we can leave it to private enterprises, we can organize mixed forms of private-public control and implementation, and so forth. We can also decide, as a society, that potential benefits of a new technology are outweighed by its costs—direct or indirect, foreseeable or only suspected. Decisions to be made in this area encompass the wide range of public measures designed to control, speed up, delay or prevent technological development in the light of their economic, social and political implications. Among the three areas of decision-making that I shall

talk about, it seems to me that we are best prepared to deal with this first one. We have made decisions of this kind in the past—certainly not always the right decisions and not always in time—but no basic institutional and procedural change seems to be required.

The second statement is about the easily observed fact that technology tends to have both positive and negative effects. And it usually has the two in virtue of each other. Our institutions are well geared, by and large, to develop technologies for their positive effects. This is true, of course, of private enterprises. Their record in exploring new technologies for new goods and services for which a customer can be found is outstanding. It is also true, although perhaps to a lesser degree, of specialized public agencies which are entrusted with the task to develop, for example, nuclear energy or space technology. But we are badly organized for facing the negative side effects of technology, to the point where no individual or institution is in a position of responsibility, authority, and expertise required to deal with these issues. It is in this context that we find a dangerous gap between technology and our social mechanisms. Let me exemplify this by talking about the shape and governance of large cities.

Technology, clearly, has always been an important factor in shaping cities. During the period of industrialization, technology was a strong centralizing force.[1] Large factories, mass immigration from rural areas and abroad, large numbers of workers, railroads, ports, banks, and high-rise buildings exemplify this trend. To be sure, slums grew as cities grew. But the city was the main beneficiary of advances in production and transportation technologies. City growth was flowing with the tide of technological advance.

Today, this is no longer so. Technology, for the last 30 or 40 years, has become a force towards social decentralization at the local level: factories now prefer large one story plants; they serve national markets from a variety of regional plants; highways and trucks made them less dependent on railroad terminals and ports. They gained

[1]The role of technology as a strong centralizing force is considered in some detail by Eli Ginzberg in his book, *Manpower Strategy for the Metropolis* (New York: Columbia University Press, 1968.)

greater flexibility in locating production and administrative units, and quite naturally they moved to cheaper suburban locations. The people did the same. The automobile made possible residential decentralization and changed the entire pattern of living, getting to work, shopping and entertainment. The congestion of the inner city, the high cost of land and transportation, gradually improving enforcement of air and water pollution legislation, a greater independence from large numbers of unskilled labor, together with a revolution in transporation and communications technologies and economic affluence of the middle class created a new social unit, the metropolis. The losers are the inner city and the poor, under-educated, unskilled minority groups.

We know about all these changes. But we have not been able and willing to make the social and political changes required to solve the new problems that we are confronted with. The metropolis exists as an economic unit (and, obviously, as a statistical unit), but not as a political unit. We go on administering our cities with political structures that were designed for the 19th Century, designed for an "outdated set of technological conditions".[2]

This perhaps is the most dramatic and disquieting example of the gap that we have been talking about: the gap between technology and our social institutions. It is not proof that our society or its leading institutions distort the potential of technology and use it for non-social objectives—the charge made by the socialist critique—but of our failure in following up technological change with social change.

This brings us directly to our third statement. Technology forces us to make more decisions than we did in the past as public decision, on a nation-wide level. This is the unresolved challenge of technology for our political system and for our values. The power of technology, the speed of its development, the organization of society in the form of a complex socio-economic system based on many different technologies—these factors require new forms of system-wide planning and control. This poses many problems for the

[2]J. R. Meyer, J. F. Kain, and M. Wohl, *The Urban Transportation Problem* (Cambridge: Harvard University Press, 1965).

rethinking of the functions of government, for its organization, for the pluralism of institutions in our society. In the last analysis, we are faced with an age-old ethical problem: how can we learn—and act accordingly—that the common interest is more than the sum of all individual interests?

DISCUSSION SUMMARY
TECHNOLOGY AND SOCIAL PURPOSE

There has been a premature acceptance of the claims of mechanizing education and providing for individualized instruction through technology. There has also been a narrowing or restriction of those areas considered to be acceptable education.

It was questionable whether it would be valid to develop a more efficient system of vocational education to meet technological change. Is vocational education a valid concept in today's society?

We make a mistake if we look at questions that are basically political and approach them as technological or scientific problems. However, we should not underestimate the value and applicability of the self-correcting mechanisms that do exist in science and technology.

Some system needs to be developed for education which provides feedback and measures the success of a given process. In short, the field of education could consider the initiation of a system of competition.

Technology forces us into a more national or system wide decision base. This in turn forces us to rethink our value orientation. This raises the question of the negative aspect of technology and the institutionalizing of concensus.

The fact that one is an expert in some aspect of science or technology does not make his political answers more valid. The gap between technical development and social progress increases as the potential benefit to individuals becomes more distant.

Technology may contribute to solutions but political commitments are necessary. It must be remembered that technology cannot be and will not be the single vehicle for solving social problems. The question of political control in a democracy is important.

For instance, it is possible to create new authorities for technology, education, public health, transportation and so on which are relatively insulated from democratic control. They may, as is true with vocational education, be quite efficient in developing their one clearly defined function but you end up with a system far remote from control—democratic control.

Perhaps the best procedure would be to build new incentive systems that motivate opinion for the public good.

P.W.D.

THE FUTURE OF MAN IN A TECHNOLOGICAL SOCIETY

James H. Straubel*

I suppose it should be noted, in passing, that large segments of the world population still live virtually untouched by the technological revolution to which we address ourselves at this conference.

Americans are inclined to measure human progress in terms of productivity—Gross National Product, standard of living, etc.

In parts of the world people still live in the Stone Age and may be better off for it.

We haven't had much success in measuring attitudes (such as happiness) or even defining them specifically enough to include them in our neat little packages of educational objectives.

But for purpose of discussion I will assume we mean "Man" as we see him around us in our growing technological society.

Now, in considering, as I've been asked to do, "the technological world of tomorrow", I am somewhat overcome with humility. . .for I am reminded—using the baseball anology—of some strikeouts by some very notable batters when they swung at this ball.

Consider the jet engine, which has had a profound effect on modern society and is on the brink of a revoluntionary impact on the mobility of man, and all the implications that go with it.

In the early stages of jet engine development but after the first jets were flying in this country (Germany and Great Britian were the pioneers in the development of the jet engine) a major assessment was made of the jet future by the best technical brains in this country.

It was generally concluded, though there were minority reports to the contrary, that the military future for the jet engine was very promising but that the commerical future was practically

*Executive Secretary, Aerospace Education Foundation, Washington, D.C.

nonexistent. **Reason?** Only the military could afford the jet's high operating cost and its complex maintenance features.

Result? The jet engine has proved to be so efficient, reliable, easy to maintain and so cost effective, as they say in Washington, that it outclasses the reciprocating engine by many factors, and the growth potential of the jet is enormous and is just being understood.

And not only is it superior in the air but on the ground, too.

Already the jet engine has replaced the good old low cost diesel engine as the power unit for fuel pipelines. Why? It is more efficient and economical.

Consider the Intercontinental Ballistic Missile which is not only the heart of our national defense system but is also the forerunner in many technical and management areas of our national space program.

As late as the first successful launch of the ICBM rocket booster, the most eminent physical scientist in the nation flatly predicted that the ICBM concept had basic weaknesses which would make it unworkable. **Reason?** The guidance barrier, that is, the presumed inability to direct an object to a precise point across the world.

Result? Guidance technology emanating from the ICBM development has progressed to the point that we have seen the Apollo 8 spacecraft circle, not only the earth, but the moon without anyone in the spacecraft touching a control button. **All** the guidance on the flight was directed by remote control 260,000 miles away in Houston, Texas.

But perhaps the best example of why we should approach projections of technological progress with great humility is a study made in the mid-1940's by a distinguished panel of scientists under the leadership of the late Dr. Theodore von Karman, a Hungarian genius I was privileged to know.

Dr. von Karman was asked to pull together the best brains available—no holds barred, expense no object—and project a 20-year forecast of technological advancement as it might apply to transporation above the earth. Since the study necessarily embraced all the disciplines, its implications over-reached the U.S. Air Force which order the study.

Incidentally, the study group included a gentlemen named H. S. Sen, then one of America's leading rocket scientists whom the McCarthyites chased out of the country in the 1950's, who now is in charge of Red China's nuclear propulsion and ICBM programs.

The von Karman report, issued in 1945, titled "Science: The Key to Air Supremacy", has been a valuable blueprint for the Air Force.

But consider the following:

Most of the major developments in this 20-year projection had been realized—were actualities—not in 20 years but in 10 years!

The projection made no mention of the laser beam which could revolutionize communications as we know it today.

The panel of experts did not foresee the ICBM in its present form. Manned space travel was not even mentioned.

So it goes!

It's become more than a joke among engineers that if you know how to build something it's already obsolete.

Let me add my belief that, in any meaningful sense of the word, prophesy is an impossibility.

We thought we could be sure of one prophesy, that having been born, we shall die, but with the progress in the technology of human organ transplants we can't even be sure of that.

Perhaps we **can** be sure of this—that the details between our first infant yelp and the final moment are what makes the whole business so interesting.

On this matter of prophesy most of the prophets have been off base, not because they have been stupid or unscholarly, but because our imagination is limited, and because we have not taken into account the imponderables, the irrationalities, the human passions for good and evil, that combine to make up the human spirit. Who among us, old enough to remember the Second World War, could have predicted, for example, the striking present-day reality that Eric Hoffer has remarked on—that today the **Japanese** are among the world's best businessmen and that the **Jews** are among the best fighters?

I have ticked off only a few examples to point up the fact that

because of our failure of imagination in the past we have not foreseen what has come to pass in the boiling present.

If our imagination has failed us in the past, we may ask, how can we now rally its power to help us look into the future, so that we can begin to take steps now to prepare for what may be ahead?

I have no simple answer, to be sure. But I do have some glimmerings, and since we are here to examine this problem, let me share them with you.

The first thing that I sense, **that I feel in my bones,** is that as a society, we are somehow reaching—to use the physicist's expression—**critical mass.** This is serious business. I mean that the enormous tensions created by the population explosion, by the rush of technology, the pressure for achievement, the competition, the excitement of modern life—that all these have combined in such a way as to create an irresistable urge for society to crack, to fission, to burst apart.

We see this all around us. People are searching for identity. People find it impossible to cope with the bureaucracy of big government and big industry, with the impersonality of university faculties and Internal Revenue Service computers. The young among us openly doubt what we **think** we have taught them. All too frequently, and sometimes correctly, they call us hypocrites when we talk about freedom and democracy and fair play. And this revolt is tied to the advance of technology—to the bomb, to television, to the computer.

Many of us in this room, born into the twentieth century, will live into the twenty-first century which is about as close to us in the future as the beginning of the Second World War is to us in the past. Looking down the road with our limited imaginations, what can we see, basing our projections on extrapolations of existing trends?

First, there lies ahead an enormous explosion in technology. We shall live to see advances in communications, in transporation on the ground and in the air, that will make today's telephones, television systems, automobiles and aircraft seem positively paleolithic in comparison. The same will be true in medicine. Today's faltering steps in organ transplant, artificial limbs and other haman parts, and

the like, are but the beginnings of a march toward the extension of life that will transfer the first years of middle age to perhaps somewhere around sixty-five.

Second, the enormous explosion in technology will have its negative side. Not only will technology enhance the pursuits of peace, it will also make possible advances of perhaps an order of magnitude in the destructive power of weaponry. And there will be little, if anything, we will be able to do about it, so long as there is conflict in the world.

Third, and perhaps most hopeful, as a consequence of the critical-mass phenomenon, there will begin to be a reexamination of the fitness of the institutions we have up to now accepted with little question, a reexamination of their fitness to do the jobs they are supposed to do for us.

I mean by this that people will begin to ask if the mass approach to answering society's needs has not begun to outlive its usefulness. Let me suggest how this might work in the field of education.

The traditional ideal of American education has been tax-supported compulsory public schools, the job of which was supposed to have been the preparation of children and young people for useful livelihoods in society where they were expected to live law-abiding lives, to be proper pillars of the community and share in the acceptance of the prevailing ideology of the community—that God helps those who help themselves, that hard work earns just rewards, and that any boy can grow up to be President.

As we look around us, it is increasingly evident that this vision is rapidly disintegrating. Members of minority groups believe, with considerable justification, that their *de facto* segregated public schools have evolved into useless way-stations on the road to oblivion. And the affluent, too, those of us who thought that at least we had a good thing going for us, are increasingly suspicious about the quality of the schools to which we have entrusted our own children.

Perhaps the most important probable future development, from now to the end of this century, will be not merely the enormous

advance in technology, but the **reexamination** of our institutions in terms of the **uses** of technology, in terms of the effects of technology on human beings.

This reexamination will occur, not all at the same time of course, but in a cumulative way all across the board. Until now, we have, in our energetic American way, used technology quite successfully to move people faster from place to place, to cure them of illnesses, to provide an incredible flow of consumer products to an incredible number of people, to fight wars successfully, and to do any number of other things that seemed worth doing at the time.

But in the process we have not looked very closely at what our cavalier approach has too often done to too many people. We have polluted our air and clogged our streets with the cars that have at the same time made us the most mobile people in history. We have in too many cases destroyed whole communities with ill-conceived so-called urban renewal programs dreamed up by so-called planners who themselves have not the slightest idea about the lives and cultures of the people they were planning for. We have regimented and standardized our school systems, in all too many cases, in such a way as to snuff out the very urge for learning among the children we thought we were trying to serve. And we have only **begun** to see that unless we begin to change our very outlook, the sheer weight of population in this technological age will crush us under the twin stones of revolution and despair.

This is not a pretty picture. But I believe there is hope. Hope because people everywhere in this country—not all, but enough are beginning to ask hard questions about our society and its uses of technology, questions that need to be asked.

The important thing is not the gadgetry. The important thing is our attitude. As I have said, no society has used technology so intensively and so haphazardly. But now, as we watch so many of our once sacred institutions crack and even crumble under the weight of the attacks against them by people who see that they have lost their utility, we have an enormous opportunity to start the rebuilding process.

I talked earlier about critical mass, about this nearly-universal

feeling that things are about to be blown apart. Let me allude to it again and offer a note of hope, framed in a context that may seem a little unusual, even contradictory, yet which I think does make sense.

Again, it has to do with schools, but also with the whole range of so-called urban problems. Until quite recently, most of us who, for varying reasons, but mostly because we wanted better schools, some quiet, some green grass, some clean air, and all that, for ourselves and our families, had thought that we had successfully escaped from the disaster and distress of the cities we left and to which we now return only as workaday commuters. But it has not turned out that way at all. Slowly but surely the problems have followed us out to the suburbs. Now **our** schools are often overcrowded, now **our** school boards and politicians are resisting the rising costs of financing the kinds of schools we thought we were buying. Now even **our** teachers go out on strike. Stink and sprawl afflict us too. Now the spectre of deliquency haunts us too. In a word, **we** have not escaped at all, but at best are just a little better off than the central cities and their inhabitants we left behind in our search for tranquility. **We too** are victims of the ill uses of technology. **We too** need to create a new sense of purposefulness and above all a new sense of community and identity.

And because we sense these needs, there is hope that we will begin to make the changes, try out the new ideas, take the risks, invest the money, and do all the other things we will have to do to create the kind of environment we really want—an environment in which the wonders of technology will serve us and our children in ways that will not reduce us to faceless numbers in some computerized Orwellian future.

DISCUSSION SUMMARY – THE FUTURE OF MAN

Perhaps the most important issue that we all must recognize is the question of values. Mr. Straubel brings out the point that our military future is great but that our commercial future is not so great, because of the high cost. This a key point which we must question very seriously. We take for granted that it is perfectly all right if the cost is high for the military but every penny must be

worried about and justification shown for every civilian expenditure.

The ABM system which the military is promoting will pay for over 10,000 new schools. When schools are considered, we don't fight about millions; we fight about pennies.

The question is also man's view of technology. We paint a rather bleak picture of technology. We are afraid of the new technology, the bomb. Yet, technology doesn't act. Technology doesn't communicate. The bomb doesn't communicate or act. Man does.

Why the conflict? Man with his technology can meet his needs. These conflicts have been with us from the earliest of times. We have always had conflict. But today the consequences are vastly greater. Man cannot move to a new frontier. There are no new frontiers. Man must solve his problems; he must reduce conflict. He cannot permit men like Hitler to seek technology for the purpose of control. All men must be knowledgeable about technology.

But man is still man. The human being is still the same person. Perhaps the issue is the question of equality. Are all men created equal? Suppose we assume that all men are not created equal. Suppose we assume that only certain men are capable of and have the ability to deal with the problems raised by technology and that only certain ones are qualified to go through various kinds of educational processes. If these assumptions are true, we might question whether our educational system is properly directed.

We are faced with two problems when we raise questions such as these: (1) What is it that we value? Does education have anything to do with value? (2) How do we deal with the expectations of various people? Is the concept of mass education a necessity?

It is apparent that the discussion questions really reduce to one very basic question. What kind of society shall we have? Shall it be a participatory democracy or shall it be a society ruled by a technological elite? Who shall decide the college curriculum? Who will decide whether we will have an ABM system or not?

Have we reached a critical mass? Are we, by accepting decisions by the technical elite, corrupting totally the resources of our

country? Are our people well enough educated about the technology to be able to participate intelligently in decision making? Or is there a danger they, through their lack of education in and about technology, will make the ultimate mistake? Should our schools be responsible for educating people about technology?

It may be a question of absolutes. Are we searching for the answer? Some people believe that money not spent for missiles will go to education or for fighting the war on poverty. In a self-governing political society these questions cannot be approached from the standpoint of absolutes. With all the headaches and with all its weaknesses, we do have a self-governing society. The ABM question cannot be settled in terms of absolutes. It may be an ideal and what we would like to see but you have to get into the political realities in terms of total resources and priorities.

The question of equality is very pertinent. Obviously we deal with myths in this area. Everyone isn't created equal in terms of opportunity. Everyone may have equal capabilities and we may be getting close to providing opportunities for everyone to develop their capabilities to the utmost through educational technology and individualized instruction.

There seems to be general agreement that in this country everyone should have a piece of the action. If this is so, how do we make a decision? Will our decisions be made on the basis of the demands of the equality of reason? Or are we going to make it on the basis of demands of political realities as was discussed previously? Is a representative government the way to make decisions? We seem to be questioning whether we want our representatives to make decisions for us. If so, this has major implications for our educational system.

For many years we have assumed that education was to prepare people for jobs. Is this the same as preparing a society for decision making? Do we really have an educational system in the United States? Most of our venerable educational institutions had their origin as vocational training schools. We must decide, again a value question, just what our system of schooling is designed to accomplish.

We live with many myths. Another one is that we have a choice between having technology and not having technology. This assumes we are all ready to give up the technology we have now. It assumes we are willing to turn back, to return to another age. But is this the question? Isn't the question, "What will we do with the technology?" "How will we control it for man's benefit?" Along with this reasoning is another myth. It is the myth that everyone must get into law school, engineering school or some other professional school in order to have a certain standard of living. Maybe this is a problem in our values and our economic system. Our resources are not distributed equally.

There is one final assumption which seems pertinent. It is the assumption that a person must choose between happiness and ambition. It is the assumption that happiness is at the top. As a result we have unhappy people rising to their level of incompetence. The real tragedy is that our culture almost demands that people be miserable and our educational system, designed as it is, aids the perpetuation of a system which alienates people and fails to prepare them for making value decisions which provide happiness and a humane life.

P.W.D.

TECHNOLOGY AND CHANGE: EDUCATION IMPERATIVES OR TECHNOLOGY IS OUR OWN THING

Daniel V. DeSimone*

I'd like to focus on one aspect of the enormously complex and unwieldy subject we are probing here: namely, our options with respect to technology and the future.

Implicit in each of our tasks is a look ahead to see what the future portends: Doing that, one gains a perspective about our society that's more important than specific technological novelties that probably lie before us.

Democracy, as Winston Churchill once observed, is the worst form of government, except for all the other forms that have been tried from time to time. The trouble with democracy, at least until now, is that it has been a willy-nilly form of government, a crisis society. We deal with problems when they become **crises**, not before. For a long time now it has been clear that the conditions of life in the cities and rural areas like Appalachia; the estrangement between young and old, black and white, haves and have-nots; the gradual transformation of individuals into social security numbers; the wanton destruction of our environment; the growing intensity of our cities—all of these have been problems that would someday demand attention. But we deal with such problems when they have reached the crisis level, not before.

Now let us look into the future, as we've been asked to do, and let us focus, by way of example, on the field of biotechnology. It is illustrative of the kinds of problems that an educated society must grapple with **now** if it is to arrive at a future of its choice.

What I see disturbs me, not because of the specific items of technology, but because of the potential consequences of a willy-nilly, "crisis society" approach to them. We need only name some of

*Director, Office of Invention and Innovation, National Bureau of Standards, Washington, D.C.

the predicted biotechnological innovations (some of them already emerging). No elaboration is needed with respect to the potential consequence of their indiscriminate employment:

– Genetic engineering to control hereditary defects and to create the kind of population "someone" wants. Who will that "someone" be? Shouldn't students be taught that "someone" should be all of us?

– Fertility control through sexual manipulation (presumably, by creating less females);

– Primitive artificial life;

– Non-narcotic, personality-changing drugs;

– Artificial replacement organs for the human body;

– Biochemicals to stimulate growth of new organs and limbs;

– Drugs to increase intelligence, or decrease it;

– Creation of intelligent animals for low-grade labor;

– Direct communication between brain and computer;

– Education by direct recording on the brain.

Will such communication and recording be voluntary or involuntary?

There are different schools of thought with respect to these and other technological developments of the future:

(1) *The Science and Technology Uber Alles School:*

That is, science and technology are desirable per se; the door is open, you must walk through it; it's up to someone else, at some other time, to be concerned about any consequences that may result.

(2) *The Utopian School:*

Don't worry about a thing; these are just so many more steps to the utopia man will ultimately achieve.

(3) *The Hopeful Pessimist School:*

I'm concerned but I'm hopeful we'll be able to deal with the consequences.

(4) *The It's Our Thing School:*

The future is ours to choose; everything is possible in the determination of our destiny; what we see must be done, we can

foreordain; science and technology are tools, not irresistable forces.

I am a firm believer in the "It's Our Thing School", that what we as a society want to be, we can be. The future is too important to be left to the technologists. So it is important that students be taught some of the fundamental characteristics of technology and its consequences.

First, technological innovation has been essential to the growth and renewal of our society. It has been a major contributer to the phenomenal growth in our Gross National Product. Yet, to gauge economic growth solely in terms of increase in the Gross National Product is a reflection of the inadequacy of our measures of progress. For there are other characteristics of economic performance which are not reflected in the undulations of a GNP curve. In particular, GNP statistics fail to reflect the importance of technological change in terms of the **quality** of our lives. Thus, for example, although the airplane, the electronic digital computer, and television have contributed significantly to the rise in the GNP, what is more important is that they have permitted us to satisfy wants which could not be satisfied before.

Moreover, if we note that twentieth century man has the same brain and body as his ancestor of some 20,000 or more years ago, it is clear that technological innovation, by extending man's capabilities, has obviated the need for **his** evolution and has, instead, provided him with tools to accomplish otherwise impossible ends. Beneath the seas and up in space, it is technology that sustains him, not his outmoded physical attributes.

Quite clearly, however, not all of the consequences of technological change are cause for rejoicing. Many of them, such as environmental pollution, are deleterious and avoidable, and call for social and political innovation. Other objections to technology are illustrated pointedly in this comment by Mahatma Gandhi:

> "Of what elevation to man is a method of broadcasting when you have only drivel to send out? What mark of civilization is it to be able to produce a one hundred and twenty page newspaper in one night, when most of it is either banal or actually vicious and not two columns worth preserving? What contribution to man has aeronautics made which can overbalance its use in his self-destruction? You are children playing with razors."

Gandhi resented the subjugation of India by the West and wanted to sever the ties which has been established through India's adoption to Western technology. He advocated an abandonment of this technology and a return to the unblemished past. But much as the people of India revered him, they were unwilling to follow his lead on this score. They would not endorse a policy of technological regression.

The lesson for students, then, is that it is unlikely that any society will ever deliberately **arrest** its technological advance. Therefore, it is an obligation of education that students be concerned at least as much with the **quality** of technological change as with its quantity.

I spoke earlier of the benefits afforded us by such technological achievements as the airplane, television and the computer. They may be put to adverse tasks also. But technology is not the culprit. It is not the fault of the airplane that man has used it as a weapon of destruction. The television set is not responsible for any of the drivel, violence, and shoot-em-ups transmitted to us. Nor could the computer itself be held to blame should man ever use it to guide an ICBM to a population center.

Technology is amoral.

It is an error, therefore, to hold that technology is the culprit when we talk about the consequences of technological change. The culprits are the manipulators of technological change **and** a society that permits them to go their selfish way, at the expense of the present and the future, of you and me and our children. That is what students should be taught and encouraged to be vigilant about.

So I believe in the philosphy that the future is ours to decide, that we can look to the alternative futures posed by social and technological possibilities, and choose the future we think our children and their's would want if they had the choice to make. They haven't a choice right now; the choice has to be ours. To choose for someone else is a sobering responsibility. And the choice, as I see it, is to progress without sacrificing human values, to enhance the dignity and meaning of life on a globe already too intense.

More than technological innovation, what is needed to begin to solve the problems of our time and anticipate those that loom ominously ahead is first, an awareness of what they mean in terms of human values; second, a consensus that these problems will be solved; and third, the development of ways and means to take us to the future of **our** choice.

Is there anything more important to be taught students during all of their years in the educational system? That the future is theirs to choose and plan for, that it is their "own thing"? Wouldn't that cause necessary changes in the curriculum? Because wouldn't they perceive, from the elementary grades on up, how irrelevant much of it now is?

DISCUSSION SUMMARY – TECHNOLOGY IS OUR OWN THING

We have had a tendency to look on the dark side of technology and education; when in reality, the problems being faced, the contemporary social problems, have resulted more because of our successes than our failures. The symptoms evidenced come from successes in technology and successes in education.

Isn't it true that our young people are coming out of our educational system concerned about the implications of technology not because they don't understand them but because they do? Is it not true also that more and more public decisions must be and are made in the public context? Issues such as defense, war, transportation, natural resources, and values have been illustrative of the sixties as well as our frustration of trying to devise appropriate mechanisms for conducting public debate and discussion. The problem is that we don't yet understand how to utilize the public decision making process in questions of technology and human values. The future is ours but the plan calls for placing the burden on man rather than technology. The question then is: "How does the educational system of this country equip the young and the adults alike to deal with problems of modern society and technology?" "What are the educational imperatives?"

First, it must be recognized that a vast majority of our youth regard technology in the disaster sense alone. What education must

do is provide a balance; show the other aspect, that technology is a tool to be used by society.

Second, it is important to recognize that our educational system has a major deficiency; it is geared to a certain type of aptitude which is academic. Many have done well by the system and many have not. There are a lot of individuals, a lot of human beings who are turned off by the sytem. Numerous creative writers, inventors and others who have been highly productive and creative for our society rejected the system. It was not geared to recognize their particular creative talent.

Third, we need to know much more about the learning process. We need to know much more about how the mind works. When we know more about the learning process and about the mind, then we can direct the educational process and help individuals to fulfill themselves.

If the educational system is aimed only at the kinds of people who do well under the present standards, I.Q. and aptitude, then it is deficient. What we tend to do is identify these youngsters as non-achievers and they adopt the image of themselves as non-achievers. Individuals branded as non-achievers by the educational system become non-achievers in society.

We must take into consideration the wide range of aptitudes and provide educational programs that make every child an achiever. If the educational system regards the youngster as an achiever, he would regard himself as an achiever and he would tend to become an achiever.

The system must change. It must accommodate the many aptitudes. It must provide something respectable and rewarding for all. What options and alternatives are available to broaden the system? Certainly the only answer isn't vocational education. And if it is, it must be quite different from what has been the norm in the past.

Education needs to look to the nature of institutional change. Much is happening outside the institutions of education today. Much education is taking place outside the traditional school system in companies and through many other private agencies. One of the

reasons is that the educational system is preparing people for an inadequate response to society.

The question of teaching human values is extremely difficult. It is difficult because of the home environment. Parents and adults in general stand in awe of technology. The problem is not with technology but with human beings. It is not with private enterprise. Those in private enterprise are only doing what they are supposed to do—make a profit. This is the way the system works. The problem lies with the manipulators of technological change and the society that permits the manipulators to manipulate.

P.W.D.

TECHNOLOGY, EDUCATION AND SOCIETY

Walter Lowen*

I would like to start my remarks with some miscellaneous ones, especially ones I cannot resist. I refer to the need to bridge the culture gap. Those on the liberal arts side should know something about the second law of thermodynamics. Since I have taught the subject for twenty years I thought I should give you a short lecture on the second law of thermodynamics, so that at least your guilt feelings are removed. My conclusion of the second law simply states that "chaos is beautiful".

My second miscellaneous comment pertains to an apology I have to make to Dr. DeVore. As a technologist trained and disciplined in engineering, I've developed a healthy distain for technological devices and I have no intention of being a slave to this microphone because I am much more interested in communicating with you than with the tape recorder. So, if I move around a little bit I hope that it won't upset the apple cart but it will add to the chaos and that, according to the second law, is natural.

This is really very germane to what I have to say, for I am very optimistic about the role of technology in society because my view is that we should not become enslaved by technology; rather, technology should make us free and therefore add to the dignity of man and give us more of an opportunity to be human, not less. To those outside of technology, the primary reason why this does not come across is that there is confusion about what technology really is. Technology is not, I repeat, is not, the products it has produced. Technology is not the light bulb and the automobile, the jet engine and the nuclear reactor. Rather it is what was mentioned this morning, a way of thinking; a series of methodologies that have evolved for solving problems. Now I'm not saying that the

*Dean, School of Advanced Technology, State University of New York, Binghamton.

methodologies are universal tools which will solve all problems, be it in humanities or in technology. But I think there are thinking methods and crutches which have influenced our society because it has influenced our way of thinking and I think that the best proof of this is that many of these tools have invaded the English language. I am convinced that we always know what we mean when we use the words, but as an example certainly we use the word "feed-back" a great deal. It is a very fundamental technological concept rather than a device. We talk of "critical mass," which is a very fundamental technological concept. We speak of networks, we speak of parametric approaches to systems, we speak of programming, of algorithms. These are all labels to thinking processes which characterize technology. The concept that has perhaps been responsible for visible successes in technology has been the concept of operational modeling. This is the bridge that makes it possible to apply mathematics to very complex problems. And there's really no great secret about it. Modeling means you make simplifying assumptions until you end up with something so simple that you can stimulate a system with a simple algebraic equation.

The amazing thing about this process is that usually it gets you within 80 per cent of the right answer. And this is really the engineer's primary tricks; he is not seeking perfection; he'll settle for a ball park figure. There are many jokes about the engineering method. One of my favorite ones is the way an engineer would prove that all odd numbers are prime numbers. You might recall that an odd number is not divisible, by 2 a prime number is not divisible, by anything, yielding a whole number. In the engineering approach, a rough modeling of the phenomenon would go something like this: 1 check, 3 check, 5 check, 7 check, 9 check, experimental error, 11, 13, terminate the experiment. It's close enough. Modeling then involves the concept of idealizations and simplifications and we know that the human arena is much more complex than the technical arena and is much more difficult to model. Certainly they are generally non-linear systems but this is no reason why we should not attempt to see if some of the conceptual tools of technology might not make some step forward in solving human problems.

We speak a great deal of systems today and I think that the revolution that is going on in technology now is that man is a part of the system. We have, therefore, given a great deal of thought to developing an operational model which includes man. The model grew originally out of my thinking about the motto of the State University of New York which says, "let each become all he is capable of being." I didn't know what people were capable of being, so I needed a model so that any educational system that I might design could then be related to man's strivings. I think it was very appropriate, in terms of what I said about chaos earlier, that as a technologist I will in effect give you a lecture on psychology and I will present to you my psychological model of how I see man relating to education. I hope that it may be useful for the discussions here. In line with my love for chaos, and since this is supposed to be a working conference, let me start off by giving you a quiz. All of you have been given a small card and if you would divide it in half, and give me only a few key words. In the top half I would like you to describe whatever your professional activity is, what you do when you work. On the bottom half I would like you to describe in a key word what you do when you relax. And, again, be as specific as possible. Do you like to do crossword puzzles? What's the thing that you do when you have no concept where time is going? Play golf, or whittle away at something, do finger painting, knit? Whatever your most relaxing mode of operation is, tell me that. And then, if you'd be kind enough to pass those cards to the middle, I would like to collect them to see if you're normal.

Let me develop the model for your various interests. I think of a human being in terms of a highly simplified model, with sensory inputs consisting of the eye, the ears, nose and so on, and certain motor responses for outputs. And what is very important, you need coupling between the senses and the motor responses. As far as the model is concerned, I have assumed that of primary importance in education are the sensory organs of the eye and the ear. And I will, therefore, simplify the model further, by limiting myself to those two sensory inputs. I'm ignoring smell, etc. The model is diagramatically shown in Figure 1. Next, I will draw for you what is known as

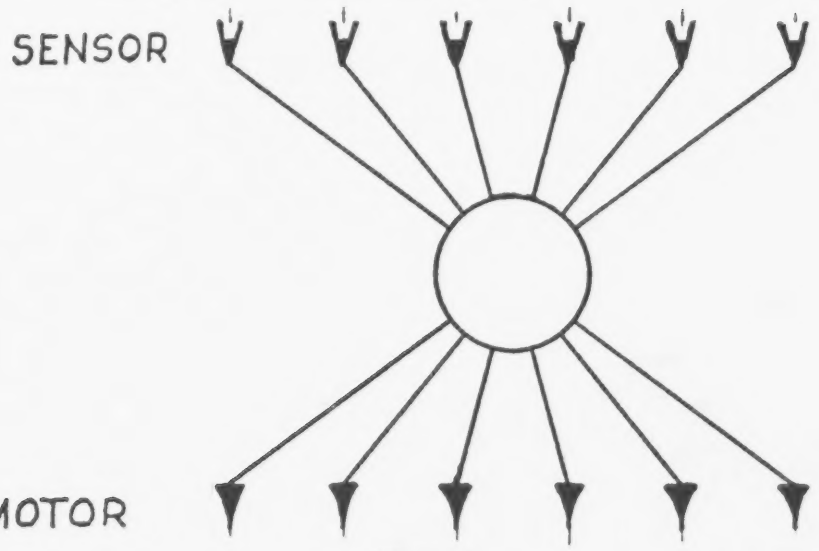

Figure 1

a polar diagram which means that we measure things in the radial direction. The zero circle will be the base from where we measure outward. The radial distance out has something to say about the intensity of whatever parameter I'm talking about. The diagram that will result goes something like this. (See Figure 2). Let each of three fields represent the ear, the eye and the motor response associated with this. Now what I'm trying to develop for you is a map which describes a spectrum of human traits, or behaviorally built-in characteristics, by relating them to the intensity of those inputs and outputs in the model. It turns out that along the vertical axis you will develop characteristics which describe how people relate to their outer world. Now let's have a look at that personality type which plots in the upward direction. It identifies a person with an extreme ear sensitivity and with significant motor coupling. I claim that it is that combination that makes a person verbal, because speaking is really a motor response to hearing. The motor response manifests itself in the way we control our vocal cords, tongue, mouth, lips and so on. People so endowed with verbal capability naturally relate to people because they are the only ones who have that communication capability. So, the way they relate to the outer world is with a **people orientation.**

If you take the opposite pole, downward, we see that the car sensory input is strongly subdued. It is dominated by eye input with

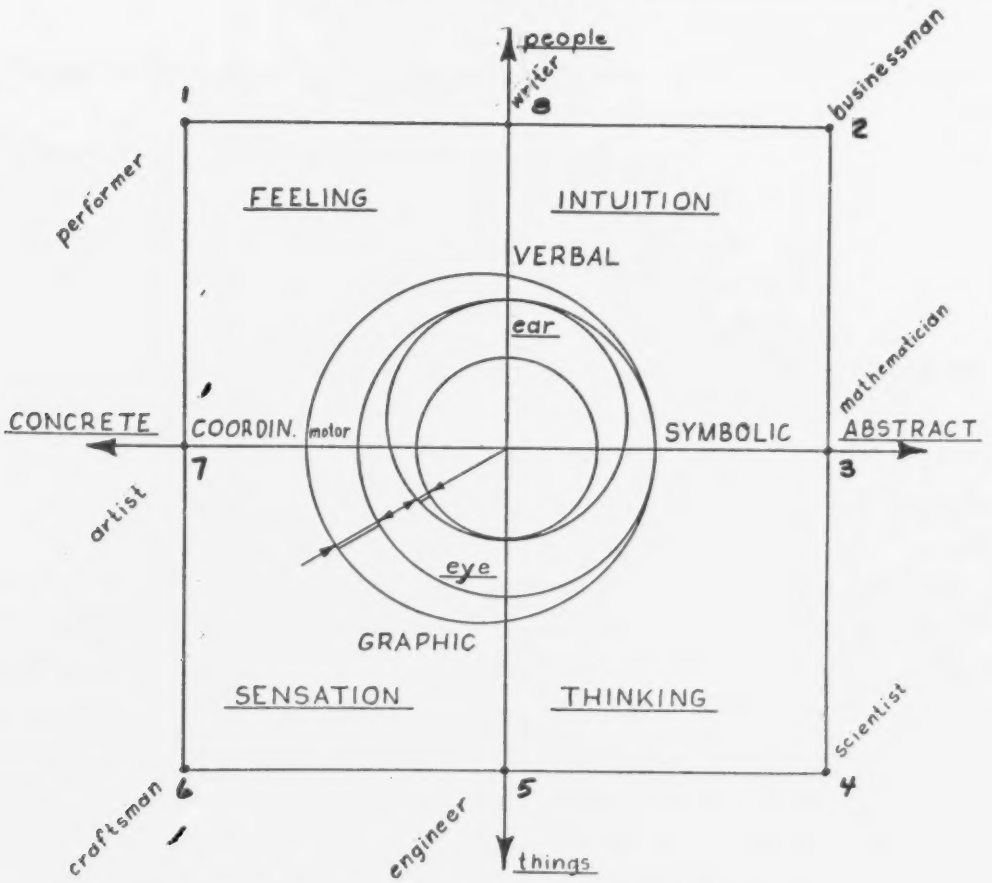

Figure 2

significant motor coupling of a different nature. Now I assume that this is what makes a person graphical and that it is the ideal communication tool to **relate to things.**

Let's have a look at the horizontal axis. The interesting thing about the direction to the right is that motor coupling is missing. These people have two reasonably strong, sensory inputs from eye and ear with no appreciable motor coupling. It is as though the coupling stays blind in the brain and finds no motor response. I call such a person **symbolic** and since I believe that this axis describes how people relate to their inner world, how they process information, I say it is this characteristic that makes people abstract thinkers.

The opposite pole, i.e. to the left has all three modes represented. I call such a person a **coordinated** individual and claim that the way he processes information, the way he relates to the

inner world, is characterized by concreteness. Now we need to go into a few more aspects of this model and we will see in a moment how this relates to the cards you filled out. I will superimpose on this diagram an additional diagram which depicts certain concepts developed by Carl Jung. Jung did some very interesting research work on schizophrenics which led him into classification systems of personality types, out of which was born the concepts of introvert and extrovert. Within that broad classification he further postulated that people could be classified according to **feeling** types, **intuitive** types, **thinking** types, and **sensation** types. And he represented this classification in a diagram of quadrants which is superimposed, Figure 2. So the upper left quadrant represents the feeling type, the upper right quadrant the intuitive type, the lower right quadrant the thinking type and the lower left quadrant the sensation type. And I think all these types are fairly self-explanatory, except for the sensation type. Since Jung lived in Switzerland, it is natural that the best illustration of the sensation type is, the "putzfrau". The cleaning lady is a person who does things in a programmed orderly fashion with satisfaction stemming from the sensual. If you take the really skilled carpenter, when he passes his hand over a piece of wood that he's been planning, he gets a signal out of all of that which not only conveys information but a sense of accomplishment. Through his sensations he reacts and this is characteristic of these kind of people.

One important thing is that Jung was engaged in research with schizophrenics and he found that people can be combinations of adjacent fields but rarely will they be combinations of cross fields. And this is vitally important and is the key of what I will be talking about. We must think of feeling and thinking as opposite poles. These are not generally merged in a personality. We must think of intuition and sensation as opposite poles not generally merged in a personality.

Now in case this whole presentation is too abstract for you let me bring it home a little. Let us illustrate the poles in Figure 3 with curricular concerns. I have a feeling part of the thinking of this conference is that everybody is hoping we can develop a better

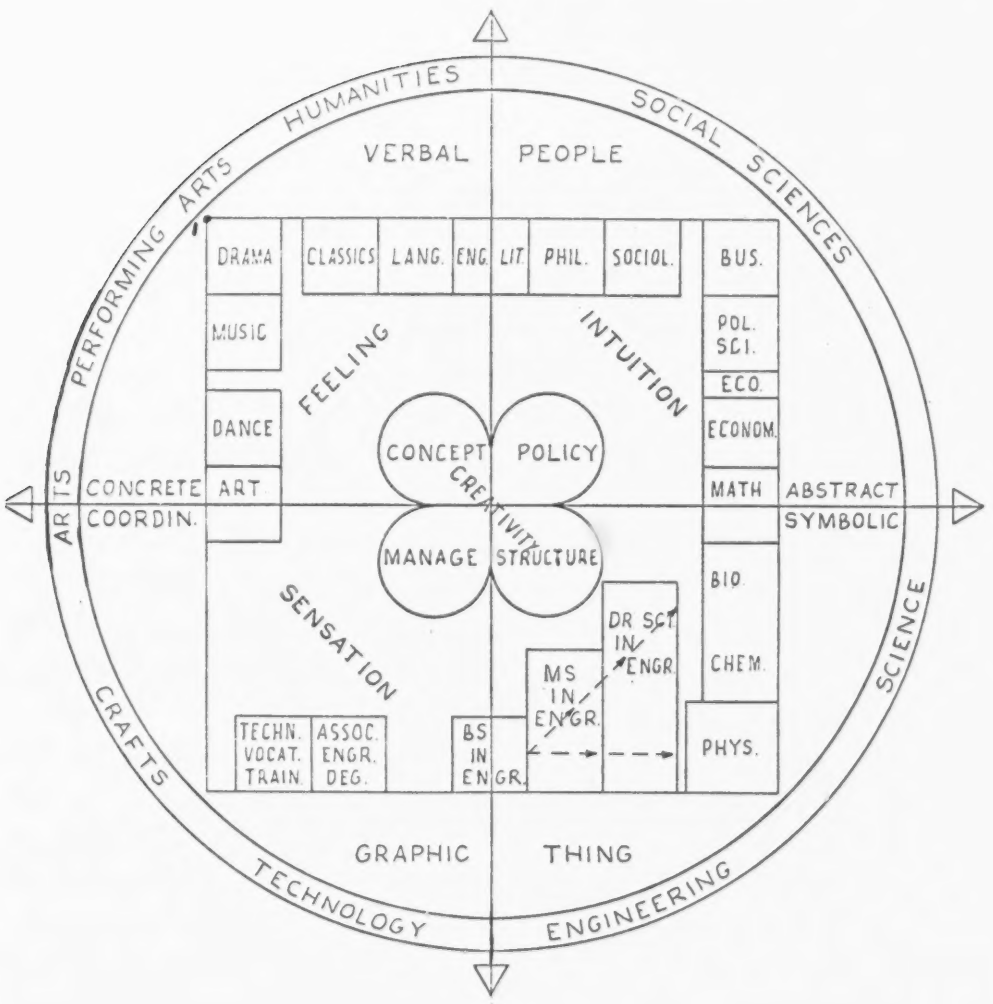

Figure 3

curriculum. Let me suggest to you that pole 1 in Figure 2 is representative of the actor on the stage. This should not be too difficult to justify. Typically the actor is an emotional person, strongly people-oriented and a very concrete individual. An actor is told what to say, he practices his gestures, is told where to enter, all of his directions are concrete. He is interested in people, he is highly verbal but he has some of coordination; he moves gracefully.

Let me suggest that pole 2 is typical of the salesman, a person who might run a men's clothing store. Again he is interested in people. But he looks at people as an abstraction. He doesn't care that it is Mr. Jones, rather he sees the customer as a type, e.g. as one to

leave alone for he will make up his own mind, or he may say to himself, I've got to talk to this guy. Talk him into it. He sizes up people intuitively because he looks at them as an abstraction. Probably he makes inventory decisions similarly. Let me suggest that point 3 is typical of the mathematician who cares neither whether he is dealing with things or people. He needs intuition for the approach to a problem and highly structured rational thinking for logical execution of this problem. His thinking is extremely abstract. Let me suggest that point 4 is typical of the physicist who deals on the abstract level in the world of things. He is typical of the thinking type. Points 5, 6, and 7 represent the engineer, the craftsman and the athlete, in order. I should fill in one more point, 8, the writer, who, in the development of his prose and plots might have to follow very concrete behavior patterns but who, in the development of characters and theme, will resort to very abstract thinking. This might give you a little better feel for the model that I'm planning to develop. Are there any questions about this?

The interesting thing to me, and I will confine myself for the moment to college level work, is that all the curricula in the traditional disciplines fall strictly around the periphery of this plot (Figure 3). The drama department would plot near point 1; foreign languages and the classics nearby. English would plot at point 8; history, social science, sociology, economics, political science, mathematics, philosophy, biology, chemistry, engineering, educational training, art, music and so on would plot as shown in Figure 3. The important conclusion is that they form a continuous spectrum going from the performing arts to the humanities, social science, engineering, crafts training and back into the performing arts. But the important thing is they all plot at the periphery. There is nothing in Academia that plots in the middle. When we talk about interdisciplinary efforts, what we usually refer to is a mix of a course from this with a course from that and we claim to have an interdisciplinary program. I'm saying that is nonsense. We must operate in the center of Figure 3 if we really want to create an interdisciplinary program. The trouble is we don't know how, we are too polarized in Academia.

I think the way that people behave is somewhat like an iceberg. There is a portion of their personality that shows, that is visible, that is operative. It is the conscious side. I call it the work side. It is the real side as we perceive it of a person. There is submerged in the personality an unconscious side which is the play side which is a mirror of the personality's real side. But I think what has happened in Academia is that we have judged people exclusively by their conscious side. And the more polarized—the more pointed—it was, the more acceptable the individual was to us as a scholar. So therefore, when I'm looking for somebody to hire in the mathematics department, I'm looking for a personality who by his inborn traits is so built that he could not help but be anything other than a mathematician. He's a highly focused, polarized individual, who has personality traits that would plot him at point 3. He then operates in setting the policy of what a math department should be and is attracted to personalities who reflect his image. Therefore, the kind of students to whom he pays attention are those same types, and they become hopefully great mathematicians who everybody else wants to hire as a professor of mathematics. In this fashion polarization becomes evermore pointed.

As another example take somebody in physics, the personality type who excels because he is an extreme type (point 4) of that polarization. Consider the typical situation where a student in this department has an extracurricular interest in the drama department. Drama is the opposition pole of the physicist, as shown in Figure 3. It represents the student's play side. He gets very interested in drama and very good at it and thus the drama professor who looks at him through his narrow-focused eyes, says, "Kiddo, you are great, you ought to take my course in Drama 101" and the student is intrigued and enrolls in drama. Then the physics professor says to the student, "You know, Joe, if you didn't play around with all that nonsense over in the theater department you might be a decent physicist". So we illustrate how we create a new personal conflict because we do not recognize that these two activities really reinforce each other because within each personality there is an unconscious side, I postulate, which is always on the opposite pole of my diagramatic model.

Now this is of extreme interest to us because technology and man form such a polar pair. Technology plots at point 5 and the humanists, those people who professionally ask questions about values, plot at point 8. If in effect the polar pairing provides a bridge for communicating with them, then there is some hope operationally of bringing those two cultures together. This means, however, awareness that people at opposite poles operate there in their play mode whereas their counterparts operate at the same pole in their work mode.

Now I don't want to take the time to look through your cards but you can play this game yourself because you know what you have written. It should be that your play side, when you relax, would be opposite your work side, according to the model just outlined. Very frequently the mathematician will have as a hobby music, which plots as the opposite pole. Very frequently the managers, the businessman, the intuitive individual will be terribly attracted to sports. Very frequently the historian is fascinated by the tedious, detailed and programmed work of stamp collecting. In other words play and work tend to be opposite poles in a given individual. It seems to me that if this hypothesis is correct then we can learn methodologies based on the model to make opposite cultures work together, as they must work together.

I think that the problems that face society today are systems problems. No engineer is going to solve the urban problem, no sociologist will, no political scientists will, no lawyer will. It's going to take all of them. But how can these people who work in special areas have sufficient insight into the operational modes of these other people who also need to come into play so that they can effectively work as a team. Only if I can give them the experience for operating on that level. We've experimented with this some. By casting problems as play situations I've taken a class of engineers and let them write plays. I've taken a class of largely social science majors and by structuring the class in play situations let them solve technical problems. And both of them have done extremely well. If the polarization has taken place in them and they know whether they want to be engineers or English majors, then they will always operate

in what is their natural side. But by awakening their play modes they can develop an appreciation, and empathy, of what it is like to operate on the other side, and this is what makes team effort more likely.

Intuitively I feel that the pre-college level youngster and to some extent even college youth have not developed sufficient identity for polarization models to be operative. If a personal identity has not first developed, we should look for extra curricular activities, group dynamics or any other enriching experience as an opportunity for people to find focus. Once personal identity has been established then we can apply techniques of the polarizations model. Academia, I find, ignores largely this thought. It does not expect irrational behavior. Academic excellence often means thinking and I think that's much too limited a spectrum of natural human capability. There should be room for intuition. No teacher should have to say to a student in a laboratory course, "don't guess, work it out." Guessing is also good. It is the powerful tool for the intuitive. We should not say to a student "Do not have these irrational emotional outbursts, that is not proper behavior in the classroom." For a few persons that is a marvelous way. So all I'm trying to say is that if we relate the academic program to what I think the spectrum of human nature is—feeling, thinking, intuition, and sensation—then it will have to become a lot broader than it is now.

EDUCATION, TECHNOLOGY AND HUMAN VALUES

Edward Layton*

Education, broadly conceived, is the way a society perpetuates its value system. This education need not be academic in the usual sense. Indeed, from this point of view the family is the most important institution for the incalculation of values. But formal education has a particularly important role in the formulation and expression of values. For not all values are equal. In any given society a few are particularly important. These might be termed "base values" or "core values": they are fundamental in the sense that they express a society's view of its own nature and purposes. Upon them will depend clusters of other values. They are like the "independent variables" in an equation; many other values will relate to them as "dependent variables." Formal education is often one of the most fundamental media for the expression of these core values.

The story of the origins of formal education in 17th Century New England illustrates the relation of education to base values. Puritan society embraced a complex system of values. These ranged from ideas of feminine adornment to the best way of building a ship. But formal education did not concern itself with the full range of beliefs in the good, the true, and the beautiful. It was explicitly focused on the core values—sin, salvation, and grace. It was intended to perpetuate certain beliefs associated with the Protestant reformation -particularly the idea that each individual should be able to read the Scriptures and, in the last analysis, seek his own salvation. Thus, the Massachusetts School of Law of 1647 made explicit the relations of this important innovation to the core values of Puritan society. It began:

*Professor, Division of Special Interdisciplinary Studies, Case Western Reserve University, Cleveland, Ohio.

> "It being one chiefe project of ye ould deluder, Satan, to keepe men from the knowledge of ye Scriptures, as in former times by keeping them in an unknowne tongue. . . ."[1]

and it went on to provide for one of the world's first systems of universal primary education. Similarly America's first college, Harvard, was founded to produce an educated ministry to articulate the core values of Puritanism.

But education, particularly higher education, is more than a mirror reflecting the values of society. Its role is dynamic rather than static; creative rather than passive. This function of educational institutions is almost inevitable, since societies, like men, are seldom wholly at peace with themselves. Core values may conflict with one another. Tensions between a society's basic values are among the most important of all social dynamics. Clashes in core values are reflected in education. But educational institutions are among the most important means of resolving, or attempting to resolve, conflicts in a society's basic values.

American education has been profoundly influenced by a tension between two of its fundamental value commitments: liberty and democracy. Between the Puritan Commonwealth and the Constitution, America went through a major social change, which may be briefly summarized as that from Puritan to Yankee. A new set of core values emerged, which were secular in character. Broadly these were an expression of the natural-rights philosophy of the 18th Century Englightenment. They were enshrined in the Declaration of Independence, which asserted both that "all men are created equal" and that they are entitled to "life, liberty, and the pursuit of happiness."

But liberty and democracy are not completely compatible. Indeed, in the European context they have often been assumed to be opposites. One meant equality, that is, making people more alike, while the other meant inequality, that is, allowing people to be different. In America, these two ideas achieved a measure of synthesis with opportunity as the common denominator. Equality

[1]"Massachusetts School of Law of 1647," in Henry Steel Commager, ed., *Documents of American History* (New York and London: Appleton-Century-Crofts, 1948), 29.

meant not literal or complete equality, but equality of opportunity. "A free field for all," became the American watchword. Conversely, liberty was seen not as a means for inequality, but as an opportunity for the less fortunate to better their lot. And if the channels of opportunity were open, Americans have been prepared to accept a wide range in achievement, from rags to riches.

This resolution of the conflict between liberty and equality did not eliminate the tension. While Americans, fortunately, have avoided fundamental differences on values—few have been willing to repudiate either democracy or liberty—there have been important differences in emphasis. Jeffersonian democracy stressed liberty. It held a notion of "natural aristocracy," and it emphasized quality and excellence. Jacksonian democarcy shifted the emphasis to equality: to social justice for all men and egalitarianism. It was no accident that one of the three achievements Jefferson was proudest of was the founding of the University of Virginia. Nor should it surprise us that one of the most fundamental reforms of the Jacksonian era was the institution of systems of universal, free primary education by the states.

The example of primary education suggests another characteristic of core values; they must be realized in practice or they will wither away. Puritanism rested on the occurance of more or less drastic religious experiences or conversions which manifested God's grace toward his chosen. Only in this way could one become a church member. When, by the end of the 17th Century, fewer and fewer people underwent these experiences, Puritanism's core values began to decline. The Half-Way Covenant was one sign of decline: it allowed the children of church members to become members without a religious experience. The revivalism of the Great Awakening was an attempt to induce conversion by new methods of preaching. But it failed to halt the decline. By the end of the 18th Century, secular values had gained primacy over supernatural ones. The secular faith that we term "American democracy" (or sometimes simply "Americanism") likewise rests on concrete realization. Indeed much of American history since 1775 may be seen as a series of

efforts, more or less successful, to realize in practice the promise of American ideals—of freedom and democracy.

In the case of a secular faith like American democracy, some of the most important dimensions are economic and social. American democracy, as de Tocqueville observed, rested on the approximate equality of condition of American citizens. Down to the middle of the 19th Century and beyond, the most important source of wealth was land. America was an agrarian republic. It was fortunate in having a vast reservoir of unsettled land in the West. And much of American politics from the Great Northwest Ordiance of 1787 to the Homestead Act of 1862 involved making this resource available to all who wished to settle and use it.

Between 1860 and 1900 a fundamental change took place in American society. The West was settled, and America became an urban-industrial nation. American democracy survived this challenge by opening up new frontiers of opportunity through technology. Inventors, engineers, and entrepreneurs served as the Daniel Boones of this new frontier, opening new pathways to opportunity. If American democratic values retained their validity (and I think that they did) it was because Americans succeeded in keeping open the channels of opportunity on a more or less equitable basis. But education, and technical education in particular, played an especially important role in maintaining equal opportunity. In the 18th and much of the 19th Centuries, the key to opportunity was access to the land. In the urban world of the 20th Century, the keys to opportunity have been skills and education. Access to technical skills and education has become for the 20th Century what access to the land was in the 19th Century.

Thus education, particularly technical education, has performed two functions in preserving the ideals of American democracy in an urban age. Technical schools have played a major and increasing role in the opening of technological frontiers, either directly through faculty research, or indirectly, by the training of technologists. A second function has been that of providing a channel of opportunity into technical trades and professions on some equitable basis for all.

Perhaps the greatest dilemma of modern technical education lies in the fact that these two functions are not completely compatible. To produce new knowledge—and hence to open new frontiers for economic growth and opportunity—requires high standards of excellence. But these same standards are among the principal barriers to truly equal opportunities for all. This tension is by no means a new one; it is simply the latest manifestation of the ancient conflict between Jeffersonian excellence and Jacksonian egalitariansim, that is, between liberty and equality. Thus in the 20th Century technical education has become one of the most fundamental arenas for the conflict, and hopefully for the resolution, of this clash between America's core values.

In attempting to meet today's challenges in technical education, Americans would be well advised to examine the history of technical education in America. For in the 19th Century America developed some very interesting mechanisms of accommodation for reconciling the competing demands for excellence and equal opportunity for all. Technical training was initially provided by apprenticeship. This produced not only artisans and mechanics but, until the end of the 19th Century, it was the most important source of professional engineers as well.[2] Formal training tended to be more elitist. In the 1840's and 1850's professional education in technology was provided by scientific schools associated with the Eastern Universities. Places like the Lawrence Scientific School at Harvard and the Scheffield Scientific School of Yale provided an important technical elite.[3]

The growing need for formal education for technologists created something of a crisis. College education was a matter for the few, not the many. America responded in at least two highly creative ways. One was to supplement apprenticeship and on-the-job training by part-time vocational education. The pioneers in this development

[2]Monte A. Calvert, *The Mechanical Engineer in America, 1830-1910* (Baltimore, 1967). Daniel Hovey Calhoun, *The American Civil Engineer, Origins and Conflict* (Cambridge, 1960).

[3]An excellent short survey of the subject is in Edward H. Beardsley, *The Rise of the American Chemistry Profession, 1850-1900* (Gainesville, Florida: University of Florida Monograph, Social Sciences, No. 23, 1964).

were the mechanics' institutes which sprang up in the 1820's in imitation of British models. The most famous and enduring of these perhaps was the Franklin Institute of Philadelphia.[4] A second response was the creation of state-financed engineering and agricultural schools to train technologists, such as Michigan Agricultural College (now Michigan State University) founded in 1855. Such schools were free in tuition, and the students were usually expected to work part-time. With the Morrell Act passed during the Civil War this idea became national. Agricultural and mechanical colleges were founded in all states.

Both the mechanics' institutes and the land-grant colleges were tributes to the vitality of the American democractic faith. They were means of opportunity and social advancement for the sons of workmen and farmers as well as nurseries for a variety of technological skills. Standards were often sketchy or low. But this was simply the converse of democratic opportunity. The sons and daughters of the poor could not be expected to have any but the most rudimentary sort of preparation for college. Public high schools were few in the 19th Century. Early land grant colleges often were forced to create their own secondary schools to prepare their students for more advanced subjects. Perhaps for the very reason that standards of admission and of achievement were low by comparison with traditional universities, these schools in the 19th Century truly served as democracy's colleges.[5]

Since 1900, the tendency has been pretty clearly to emphasize quality. Faculty quality and research have been upgraded; the undergraduate offerings have been expanded and improved in quality and supplemented, in most cases, by professional schools. The tone has been set increasingly by the needs of the graduate schools. The

[4]The founding of the mechanics institutes was part of a broad democratizing trend in American education in the Jacksonian era. For this larger context, see Rush Welter, *Popular Education and Democratic Thought in America* (New York, 1962), and Bernard Barlyn, *Education in the Forming of American Society: Needs and Opportunities for Study* (Chapel Hill, 1960). For a history of the Franklin Institute, see Joseph Bruce Sinclair, *Science with Practice; Practice with Science": A History of the Franklin Institute, 1824-1837* (Unpublished Ph.D. thesis, Case Institute of Technology, 1966).

[5]Earl D. Ross, *Democracy's Colleges, The Land Grant Movement in the United States* (Ames, Iowa, 1942).

land grant colleges gradually converted themselves into modern comprehensive universities. Such schools have lived down the reputation of being "cow colleges." But at a price. The students who graduated from them in the 19th Century would not have been admitted in the 20th. And had they been admitted it is questionable if many of them could have long survived. Tuition is no longer free. The curriculum now assumes a reasonably good high school training; without this few freshmen could survive. Nor would these unprepared, poorer students find the curriculum very relevant to their concerns or experience. The old curriculum, which combined vocational education through work experience with classroom teaching has largely disappeared.[6]

The evolution of the land grant schools was a result not only of the educators' ambitions, but of pressures from technological professions. By 1900 professionalization was in full-swing in a host of technical occupations. Engineering is perhaps typical, and I will draw my examples from it, both because it has emerged as the largest technical profession and because I am most familiar with it. Professions are dedicated to the preservation of quality. And everywhere professionalization has been accompanied by efforts to improve quality and restrict admission. No doubt some of this has stemmed from a laudable desire to protect the public. But beyond this manifest function, improving quality has had the covert effect of restricting supply.[7] Thus, high standards of admission, of licensing and the like are means whereby professions alter supply-and-demand relationships in their favor; by creating a scarcity for a given talent, competition is restricted, and the prices charged for professional services go up. The classic case is medicine. After the Flexner report

[6]Michigan State is cited here because it is more or less typical. Other examples could be cited. For example, at Purdue engineering students used to spend a great deal of time in machine-shop and foundry in what was essentially vocational education. See Madison Kuhn, *Michigan State – The First Hundred Years* (East Lansing, 1955). Horton B. Knoll, *The Story of Purdue Engineering* (West Lafayette, Ind., 1963).

[7]This is not a "latent function" in the sense intended by Robert K. Merton, but a covert major premise. In the discussions of licensing among engineers the restriction of supply has always been foremost.

there was a drastic upgrading of the standards of education for the medical profession. But another result was to increase the cost of such education so as to exclude many who might be otherwise well qualified.[8]

Engineering and other technological professions have not been as successful as the doctors in raising standards and restricting admission to their ranks. But this has not been for lack of trying. The quality of engineering education has been steadily upgraded; it has become a very exacting and rigorous curriculum. Only the well-prepared and bright can survive. Licensing laws and other measures have done much to close the profession. The motivation behind these laws is quite clear. Engineers have sought to restrict supply in order to increase their income and their relative bargaining position. The first major effort to secure licensing laws was by the Technical League formed in New York in 1908. It was made up of younger engineers, and their aim was to restrict the practice of engineering to those with college degrees. This crusade was continued after 1915 by the American Association of Engineers; by 1920 the AAE had secured licensing laws in about one-half of the states. With the prosperity of the 1920's the demands for restriction of supply declined, but they were revived in the 1930's by the National Society of Professional Engineers. The NSPE, like its forerunners, was opposed by the larger national societies—the so-called Founder Societies. But by 1947 all of the states had adopted licensing laws.[9]

While the older societies resisted licensing, and succeeded in preventing the enactment of laws as stringent as those for medicine, the result has still been a steady upgrading of quality. The Founder Societies formed their own Engineers Council for Professional Development. It sought to restrict admission to engineering colleges

[8]W. Lloyd Warner, Robert J. Havighurst, and Martin B. Loeb, *Who Shall Be Educated?* (New York, 1944), 72. See also Stuart Adams, "Trends in Occupational Origins of Physicians," *American Sociological Review,* XVIII (August, 1953), 404-409.

[9]For a brief survey of licensing laws for engineers see E. W. Ellis, "Licensing and Registration of Engineers in the United States," *Mining and Metallurgy,* XXV (January, 1945), 22. For a history of the movement see this author's, *The American Engineering Profession and the Idea of Social Responsibility* (Unpubished Ph.D. thesis, U.C.L.A., 1956), 236-247.

by more "gentle" means. By means of certification of curricula and other devices, the quality of engineering education in America has been upgraded.[10] But the converse of higher standards has been lessened opportunity.

How effective were the measures adopted by the engineering profession and engineering educators to restrict admission into their profession? There is much evidence that they were only too successful; that opportunity, especially for the sons of the less advantaged members of society, has been greatly limited. In the early 1920's the Society for the Promotion of Engineering Education conducted a large survey of engineering education. As part of this study questionnaires were administered to 20 per cent of all engineering freshmen admitted in the fall of 1924. These students were selected from thirty-two engineering schools so as to constitute a representative cross section. The results were a source of self-congratulation for the engineering educators who were pleased to find that their students came from "good stock." But they indicated that admission to the profession was being denied to substantial segments of the population.[11]

One of the most important kinds of bias in engineering education revealed by the 1924 study was economic. Admission was almost exclusively for the middle and upper classes; the working class was largely excluded. To be more precise, only 2.7 per cent of the fathers of these children came from the mass of workmen. The lower-middle class was slightly better represented: some 13 per cent of the fathers were skilled workers and another 3.5 per cent were the children of clerks. On the other hand the middle and upper income groups were greatly overrepresented. Forty-two and one-half per cent of the fathers were owners or proprietors of businesses (including farmers who made up 17.1 per cent of the total). Another 28.2 per

[10]C. F. Hirshfield, "Engineers Council for Professional Development," *Mechanical Engineering*, LIV (September, 1932), 634. One of the major means employed to upgrade engineering curricula has been accreditation. This has worked in two ways: by increasing the number of courses to be taken and by raising their quality.

[11]Society for the Promotion of Engineering Education, *Report of the Investigation of Engineering Education 1923-1929.* (Pittsburgh, 1934), I, 161-162. (Hereafter cited as SPEE, *Report*.).

cent of the fathers were employed in executive and supervisory positions. About 5.6 per cent of the fathers were engineers or teachers.[12]

Perhaps even more striking than the economic bias in the recruitment of engineering students was the ethnic discrimination revealed by the 1924 study. The parents of these students were overwhelmingly of Protestant, Anglo-Saxon or Northwestern European stock. Of the students 96.2 per cent were native-born, as were 73.6 per cent of their parents and 60.7 per cent of their grandparents. Of the grandparents not born in the United States or Canada, two out of three were from Northwestern European countries – 29.4 of all of the grandparents. Only 6.2 per cent of all of the grandparents were from countries of Southern and Eastern Europe. Another index to this bias was the fact that these students came disproportionately from small and middle-sized towns. Large cities were proportionately greatly underrepresented. Nearly 62 per cent of these students came from cities with a population of 25,000 or less.[13]

Unfortunately, it is not possible to find contemporary statistics as complete as those of the 1924 survey. The best available is a study by Robert Perrucci, William K. LeBold and Warren E. Howland sponsored by the American Society for Engineering Education and published in March, 1966. This work contains evidence that discrimination based on economic class has lessened. In surveying 4,000 engineering graduates employed by 150 organizations, these investigators found that the proportion of engineering graduates who were the sons of independent proprietors, managers and other white-collar occupations had declined significantly, while sons of blue-collar workers increased considerably. In the 1966 survey, 32 per cent of the fathers were skilled or semi-skilled workers. Unfortunately this study did not break down this figure into the elite of skilled workers and the mass of ordinary workers, but the authors did note that the upper range of blue-collar workers was disproportionately represented. While these figures on engineering

[12] *Ibid.*, 163-164, 188.

[13] *Ibid.*, 162-163, 188-189.

graduates are not strictly comparable with those for entering freshmen in 1924, it might be noted that the combined total of sons of skilled and semiskilled workers rose from 15.7 per cent to 32 per cent. This figure certainly suggests that purely economic discrimination against working-class children has greatly lessened.[14]

The 1966 study presents no data on the ethnic origins of engineers. But its findings are consistent with a common observation among engineering educators, that the profession is now fairly open to persons whose ethnic origins may be traced to Southern and Eastern Europe. Specifically, Jews and Catholics are not excluded any more. But there is reason to believe that the older patterns of ethnic discrimination continue, but now against new groups, particularly against Negroes, Spanish-Americans (such as Puerto Ricans and Mexicans), and poor whites from Appalachia. The census figures provide an index of this pattern. In 1960 non-whites constituted from 0.8 per cent to 2.1 per cent of all engineers, depending on specialty. The overall average would be less than 2 per cent, though Negroes alone constitute well over 10 per cent of the total population.[15] Another way of expressing this point would be to note that the old inner-city neighborhoods in large metropolitan areas are greatly underrepresented in the engineering profession.[16] Once inhabited by immigrant stock from Southern and Eastern Europe, these neighborhoods have been taken over by Negroes, Spanish-Americans, and other disadvantaged groups. Whatever their ethnic origins, children growing up in these areas are effectively excluded from the engineering profession.

We have at least some reason to suspect that this pattern of restricted opportunity applied not only to engineering but to other technical professions as well. Engineering and school teaching have traditionally been the most accessible professions, since they can be entered after only four years of college. Other technical professions

[14]Robert Perrucci, William K. LeBold and Warren E. Howland, "The Engineer in Industry and Government," *Journal of Engineering Education* LVI (March, 1966), 238-240.

[15]*Statistical Abstract of the United States*, 1968, table 327, p. 227.

[16]Perrucci, LeBold, and Howland, "The Engineer in Industry and Government," 239.

are more likely to require graduate work—a more severe and effective way of eliminating the lower half of the income pyramid. At the other end of the scale a host of would-be professions, from beauticians to the recently renamed group of "Sanitarians" have been busy attempting to raise standards by securing state licensing laws, requiring college degrees, and otherwise imitating the older professions. Needless to say, these laws would be less common if they did not traditionally include a grandfather clause to certify current practitioners, requiring only new entrants to meet the new and higher standards.

How real is the discrimination in the recruitment of engineers? To put the matter in another way, are many bright youngsters really denied the education which their intellectual potential would make possible? The answer, unfortunately, is clearly "yes." Much of the data available is based on the Army's use of intelligence tests in the First and Second World Wars. If the results are grouped by occupation, and arranged in order of descending average scores, with the highest at the top, it is quite clear that the higher-status occupations have higher scores than do those of lower-status. But both the standard deviation and the range of scores increases as one goes down the list. Thus, while the lower range of scores goes down with the status of the occupation, the upper range remains approximately the same. For engineers the scores ranged from 100 to 151; for truck drivers from 16 to 149. While the lowest score declined 84 points, the upper score dropped by only two points. Thus, though truck drivers tend to score lower than do engineers on the average, it is equally clear that a significant number are in fact brighter than most engineers as measured by this Army test. But in any status-ordering of the entire population tends to be pyramidal: there are more people in lower-status occupations than in those with high status. Therefore, as one descends the economic and status pyramid, the proportion of very intelligent people goes down, but the absolute number goes up. That is, there are more very bright people in blue-collar jobs than in the managerial and professional elite.[17]

[17]Theodore Caplow, *The Sociology of Work* (Minneapolis, 1954), table 1, pp. 50-51.

Modern technical education in America thus stresses quality at the expense of opportunity for all. We need quality; but we also need social justice. America's core values require a balancing of liberty and equality. And the plain fact is that we are wasting most of our resources of very bright people. We spend enormous sums to conserve the whooping crane and the condor, to preserve our forests, and protect our natural heritage. But we show less interest in our most precious resource of all—human lives and human potential. At a time when technical and scientific brainpower is in critically short supply, we allow about half of our very talented young people to waste themselves in jobs where they cannot realize the potentialities that are within them.[18] Even more serious in the long run is the threat that this pattern of discrimination poses to our national ideals. The American democratic faith was founded on the idea of an equal opportunity for all. In the modern age these opportunities are available chiefly through education and skills, which we deny to a majority of those capable of grasping them. As David Potter has written: "our democratic system. . .like other systems, can survive only when its ideals are realized."[19]

In considering possible remedies for the present situation, it should be borne in mind that the principal bottleneck is college education. The high school dropout is not likely to be among the intellectually ablest. A number of studies have indicated that intelligence is much more important than socio-economic background in determining success once a student has been admitted to college. The important gap is the one between high school and college. William H. Sewell in a recent study of Wisconsin high school seniors has shown that socio-economic factors are extremely important in determining who shall go to college. He found that while 90.7 per cent of male students with high intelligence and high

[18]Dael Wolfe, *America's Resources of Specialized Talent, A Current Appraisal and A Look Ahead* (New York, 1954), table VI. 13, p. 183. Wolfe estimated that for very bright students (those with AGCT scores of 130 or higher), 55 per cent of the men and 37 per cent of the women graduated from college, for an overall average of 46 per cent.

[19]David M. Potter, *People of Plenty, Economic Abundance and the American Character* (Chicago, 1954), 93.

socio-economic background attended college, only 52.4 per cent of those of high intelligence but low socio-economic background entered college. It should be noted that Sewell's figures, if anything, tend to understate the problem. There is much evidence that intelligence tests are biased in favor of those from upper-status backgrounds. Wisconsin is also a very progressive state with a diversity of educational opportunities. Besides its prestigious state university it has a system of nine state colleges offering four-year curricula at low cost, and a network of university centers which provide two years of college.[20]

I do not wish to imply that the issue of equal opportunity in technical education has been wholly neglected. A great deal of effort and thought have gone into creating a truly democratic educational system in the years from the President's Commission on Higher Education created by President Truman after World War II down to the recent Coleman report on Equality of Educational Opportunity.[21] Perhaps our most notable concrete achievement has been the creation of a system of vocational-technical education, much of it centered in two-year community colleges, but also associated with four-year colleges and universities. My own state, Ohio, is about to embark on a large expansion of its work in this field, while the state in which I was born, California, already has what is perhaps the most impressive system of which I am aware.

Several features of vocational-technical education are worth reviewing, even if already familiar to most of us. It tends to minimize the effects of income and social class. Most of these institutions are tuition free and located close to the student's homes so that living expenses are drastically cut. The curriculum is highly relevant to the student's needs and he has less difficulty in understanding why he

[20]William H. Sewell and Vimal P. Shah, "Socio-economic Status, Intelligence, and the Attainment of Higher Education," *Sociology of Education* XL (Winter, 1967), table 3, p. 13.

[21]President's Commission on Higher Education, *Higher Education for American Democracy* (New York: Harper and Brothers, 1947). James S. Coleman, et. al., *Equality of Educational Opportunity: Summary* (Washington, 1966). For a discussion of the Coleman report, see the special issue on "Equal Educational Opportunity," of the *Harvard Educational Review*, XXXVIII (Winter, 1968).

should be doing what he does. They demand less of the student in the way of prior preparation, thus, compensating, in part, for the cultural deprivation of a less advantaged background. They are pluralistic, in that they allow the student to follow a number of possible paths, including transfer to a four-year college for one of the traditional curricula such as engineering. In short, these schools are the lineal descendants of the mechanics' institutes and land-grant colleges of the 19th Century. They meet many of the tests for a democratic education. They are important instruments for the balancing and accommodation of America's core values, for reconciling liberty and democracy.

But in at least one respect our present-day education is less democractic and less successful than that provided by the old mechanics' institutes. And this is for the very bright. In the 19th Century such people could go to work and then expect to rise to professional and managerial jobs by self-training, by part-time study, and by sheer merit. Indeed, until the 20th Century this was the normal means of recruitment for professional engineers and business executives. America worshiped the ideal of the self-made man, of the rise from rags to riches. As a result, employers and the technical professions encouraged this pattern of advancement. If anything, the prejudice was against the college man. But now the situation has reversed itself. We have become more class stratified. It is much harder to rise from blue-collar work to the technical professions or to management. This change may be illustrated by two quotations. In 1834 *Mechanics Magazine* editorially complained that:

> "some enterprising carpenter or mason of the neighborhood, becoming possessed of a level and compass, styles himself engineer, and is forthwith, for want of a better, employed. . . . .as such."[22]

But in 1949 James Kip Finch, Dean of Engineering at Columbia and historian of the profession noted that:

[22]"Editorial," *Mechanics Magazine*, IV (November, 1934), 271.

> You will find today that it is rare indeed that a progressive industrial organization has any college graduates in its drafting rooms or on its surveying forces. Mighty few industries go to their engineering forces. The line between the technicians and the college trained engineer is being ever more sharply defined. . . .Year by year fewer men can rise to professional status from the technical ranks.[23]

An acute observer of the enginerring profession, John Mills, observed in 1946 that the old democracy among scientific workers was rapidly disappearing. Engineers with degrees looked down on technicians struggling through night school. Similarly, sociological studies have indicated that informal class lines on the job are often very strictly drawn.[24]

The problem is not simply one of education. We should, indeed, make provision for technicians and others to upgrade themselves by part-time study and work experience. Such facilities are by no means lacking at present. They should be enhanced. Vocational education should be open-ended; it should allow the student to rise as high as his intelligence and ability warrant. But beyond education there are formidable barriers to be overcome. They have their roots in the class prejudices and racism which are only too pervasive in our society, and which are the ultimate origin of the selectivity and discrimination in the recruitment of engineers, whatever the specific mechanisms might be. In particular, there are two groups that need to be reached: the technical professions and employers. Professionalism, however desirable in other ways, has been a primary source of discrimination. Employers might be encouraged to look again to their drafting rooms and work shops for promising talent. The task is not easy. But it is essential to the preservation of America's basic values.

[23]James K. Finch, "Recruiting for the Mining Industry," *Mining Engineering,* I (June, 1949), Sec. 1, p. 8.

[24]John Mills, The Engineer in Society (New York, 1946), 106-112. Melville Dalton, "Conflicts Between Staff and Line Managerial Offices," *American Sociological Review,* XV (June, 1940), 346-347.

DISCUSSION SUMMARY
EDUCATION, TECHNOLOGY AND HUMAN VLAUE

Equality of opportunity in the United States so far as occupational choice is concerned has not been realized. One of the factors excluding people from certain professions is the requirement of a college education. The person, after four years of college, may not be better prepared but he does have the credentials to enter certain fields and to engage in on-the-job training. The requirement of a college education has, therefore, had the effect of limiting educational opportunity, particularly in the professions. The college requirement tends to exclude the lower half of the social-economic pyramid thereby enhancing the value of elitism. No one is really to blame for this fact. The fact that it is permitted indicates a value choice which produces a conflict in our society.

It is a conflict within our value of equal opportunity. We seem to have a guilt complex and are leaning over backwards in areas of social justice. Yet, we deny education and skills to a majority of our people.

The questions we must answer are those which ask: "What education?" "For whom?" "When?" "What core value do we use as a guide to settle the questions and provide social justice?"

There is a tendency in our country toward class rigidity. We have established guilds which keep people out of occupations. Our value systems are not completely compatible. Equality of opportunity doesn't really exist.

Our contradictions in values involve tensions. Many times people are unhappy that this is so but by and large people have the capacity to live with tensions within their ideas. They do this by developing mechanisms of accommodation which enable them to balance the conflicts. For instance, in the United States the way we have tended to balance and accommodate liberty and equality (which in many ways are incompatible) has been by stressing equality of opportunity.

It is not that the values of liberty and equality are bad. They are a part of a very old value system and still quite valid. However, these

values or any values do not exist in limbo even though some people like to think of values as absolute entities that exist "out there" somewhere in a true or false situation regardless of what happens down on the corrupt earth.

Many values have been held sacred over the centuries but when the values couldn't be realized in practice they inevitably decline and fall from favor.

If in America, the value of free opportunity for all fails in application then our value system fails with it because the inner tensions between the notions of liberty and equality will cause a serious cleavage. The problem is not always the formal restrictions. Generally they are much less severe than the informal. It is the informal restrictions that limit opportunity. A limit has been placed on a free field for all. We have placed effective handicaps on the youngsters born in the disadvantaged neighborhoods, the ghetto children of America.

One might ask: "What can we do?" A long term solution would be to change the framework of society so racism, class prejudice and other limiting factors don't exist. But this does not meet the needs of people today and one must begin somewhere.

The short range solution and the solution used by American technical education in the past in meeting the problem of the underprivileged people is to tailor the educational system to meet the needs of those being served. The great virtue of the mechanics institutes was that they were designed for mechanics. They were open at hours mechanics could attend. The same was true of the land grant college which enabled the sons and daughters of farmers to step upward in the social hierarchy without having Latin and Greek in a special preparatory school. The land grant college provided more people an opportunity to advance socially.

It may be that our system of education is not as democratic as we believe. Over the years, of course, we have eliminated the formal entrance requirements, such as the exams used in England and Europe, but at the same time we have established informal barriers which actually deprive the talented children of the ghetto from entering the better schools or professions.

It is apparent that we have arrived at a critical juncture, a juncture where we are questioning basic values. How do we measure the value of a human being? What is the value of work to man? Leisure? What makes a person a valuable person? Is it the fact that he earns $150.00 per week in the coal mines? Is social and upward mobility necessarily good? Haven't we paid a terribly high price as a society and as individuals for this value? Doesn't this value generate a feeling of personal failure on the part of the vast majority? Have we not, as a culture, enhanced this tragedy?

The same value has in some measure destroyed a basic human need—the feeling that a job has been done well. We enhance the belief that to do a good job as a carpenter is not enough. What is necessary is that the carpenter strive to become an engineer. What has been created is a social inferiority of occupations which is linked with income. We encourage the individual to be competitive at a time in our history when the frontier is gone. The competitive value system served our country in the period of the frontier, but not now.

Behind every educational decision is either a conscious or unconscious value which determines direction. What is necessary is that we recognize the critical nature of values in decision making and in the creation of a society and an educational system that enhances those elements of society that make us all more human.

P.W.D.

SUMMARY OF TASK GROUP DISCUSSIONS

Edited by Wil J. Smith

Task Group I – *Raymond M. Haas**

The thing that has occurred to me is that we have become overwhelmed with problems. There are all kinds of problems. There are all kinds of grounds for pessimism and distrust. In the last couple of days I have sometimes felt that there are no immediate solutions. If I could only come up with the act of an angel and give you all the answers! I have been distressed with the fact that this conference seems constantly to suggest that technology is advancing and apparently will continue to advance. In the future technological change will be accelerated. It will have the financial resources; it will have the resources of personnel. The economic rewards are there waiting for those people who gain admission through education into technological occupations.

We keep saying that the problems of technology call attention to questions of value and necessitate solutions to these problems that are not technological solutions but political, economic, and sociological solutions. Economic well-being, it seems to me, involves supporting this kind of activity at least in some kind of a commensurate way with the demands and needs of the people going into technology.

Most of us who have just received our contracts for next year are well aware of the disparity between the rewards in one discipline and the rewards in other disciplines. To say that someone for example, should become a social worker rather than an M.D., or to say that he should perhaps go into teaching and get a starting salary of $5200 to $6300 annually versus the M.D. (Intern) who has a

*Assistant to the President and Associate Professor of Marketing, West Virginia University.

higher starting salary, is to say a great deal and to assume a large responsibility.

Yes, we have these overwhelming political problems. But the thing that has impressed me most is the fact that one can't come up with, say, a sense of ultimate meaning. We can't even come up with a sense of intermediate meaning.

The fascinating part of this session was seeing how small groups went off and organized themselves with completely nothing; how they organized and derived the kinds of things we are going to talk about here. It will be more of a lesson in psychology than it will be a lesson in the problems of technological society.

In our group we went around the room and asked each person to come up with what he felt was perhaps the most salient point that he could think of coming out of the conference, hoping that these several points very randomly produced might generate some discussion. Some of these, I think, are very important and I will pass them on to you.

There was an expression of agreement with the model of a "whole man" that we pursued in yesterday afternoon's session and several members of our task force group felt that this model should be employed in the development of a curriculum in technology. Another person expressed a point of view that we should be concerned with making education more a science than an art. We spent considerable time discussing the nature of man and arguing the merits and demerits of the humanists' definition, the Judeo-Christian definition, and other definitions. There was some consensus in our group that if man is a technological being, then his values will be technologically based and these values will not be the traditional values. Someone expressed concern about whether technology was a "thing" oriented phenomenon or whether it was a state of mind. There were some who specifically recommended that technology (i.e., industrial arts) should be a course of study for all persons at all levels of instruction, and not just be a shop class taken in high school by a select few. The whole topic of technological progress and social progress was opened up again and we discussed the type of education that would lead to a fulfilled human being. The question of adult

education received extensive attention. We then proceeded to a more systematic approach in which we tried to apply the scientific method to our discussions by defining what we felt would be objectives of society in this area. Every member of our task force group suggested some objectives and then some of these were striken. We proceeded from there to state what we felt were some specific public policy recommendations that would help in the achievement of these objectives. We, of course, recognized that by coming up with solutions we were inferring that there were some problems that stood between the objectives and the solutions. And I think all members of our group were mindful of the fact that it is much easier to articulate objectives and solutions than it is to articulate and define problems, at least in a very meaningful manner. We were more in agreement on solutions and objectives than we were on the nature of the problems. I don't know what that indicates. We'll leave that for you to decide.

We agreed that some of the objectives of our society should be provision (and attainment) of health, education and welfare services; individual fulfillment; equal opportunity; justice under law; economic well-being; national security; a sense that life has ultimate meaning; enjoyable leisure; opportunity for beauty; satisfying social relationships; and an opportunity for self-identification. We then came up with these specific policy recommendations. They cover the whole spectrum from higher education, secondary education, and elementary education policies, etc.

One recommendation, a specific policy recommendation, was that wherever technology is studied its implications for human beings should also be studied. Every industry should have an impartial assessment team to determine annually the industry's contribution to society. At all levels education should be emphasized in our institutions of education rather than certification. It was strongly recommended that education should be like a huge buffet or cafeteria where persons could drop in and out as they chose. If we were more concerned with education than mere certification there would be no stigma attached to this dropping in late or early; no stigma attached to picking up those things a person felt he needed and overlooking those things he might not be interested in at that

time. In other words, our group felt there had to be some mechanism whereby a person could correct his mistakes if he chose incorrectly at some younger age.

Another specific recommendation was that education and the study of technology should be available to all. It was suggested that technology be inserted formally as an area of study and that it be included in the series of textbooks running from kindergarten through the 12 grades. A committee should be established to develop a curriculum in technology from kindergarten through higher education. Also, professional schools should be brought back into the university to eliminate duplication and to introduce a greater portion or more intensive study of the humanities into their curriculum. In addition, greater emphasis should be placed on the delivery of social progress, not on the mechanisms for the delivery of social progress.

Much time was spent in defining objectives and coming up with specific policy recommendations and trying to infer from these recommendations the problems that we were really dealing with what prevented us from achieving our objectives. The objectives of equal opportunities were discussed and we reached a consensus that the major problem that prevented society from achieving this state of equal opportunity was the situation of unequal environment. Unequal environment in the home, the culture, in education and in aspirations. We therefore tried to make more specific our policy recommendations and felt that the material for educational institutions should be more relevant. Since persons pursuing knowledge work better from a familiar base to a less familiar base, the materials which were made more relevant would be more instructive and worthwhile. There was near unanimous agreement among the members of our task force group that per capita expenditures for education among the states and in West Virginia's counties be more equalized; that there be a more active recruiting of students for enrollment in educational institutions (especially higher education); and that education be made easily accessible to everyone at all stages of life. Of course, this goes back to our previous discussion of the cafeteria model for education.

The next objective that we discussed in depth was that of economic well-being. The specifics of the problem was of less concern to us in this case because economic equality is one of the more palpable types of inequality. The specific recommendation here was that the traditional industrial arts programs should broaden their perspective from the materials-oriented curriculum and that there be established within the College of Human Resources or the Department of Education a Center of Technology that would have as its principal charge a coordination of sciences and humanities and assume the responsibilities of broadening the perspective of both the technologists and the humanists. Hopefully this would result in a managed technological phenomenon in our time which would be human centered and human concerned. I believe that summarizes the deliberations for the two sessions Task Force I met.

Mrs. Hilton: Thank you very much. Rather than trying to comment on the task force group reports individually, I will withhold my remarks until all three reports have been given. I will then try to discern the common elements which pervade all three summaries.

Task Group II – *George Weaver**

Task Group II tried to decide which of these broad issues we might discuss. I must admit I felt at times that we were in a soccer game, and we had three teams on the field and were playing with two balls. Finally, along about this morning, in a complete panic of having to make this report, I dropped back on third down and punted and found it was the wrong game. We started by looking at questions suggested to the task group and after considerable debate we decided that maybe number 5 might be our cup of tea. I will read number five. I think at times not having taken shorthand as part of my technological background I missed some of this. But I must admit at this point that we changed at least 62 per cent of the wording of question number five before we decided we could really discuss it. Question number five in its original form asked us to "list

*Assistant Dean and Professor of Engineering, West Virginia University.

and describe competencies required by citizens to function effectively in a democratic society which is at a high level of technological development and to identify and briefly describe the categories of technological knowledge and skill required by all citizens." With considerable debate, the members of our task force finally arrived at five consensus statements. These statements might not particularly answer question five but we really didn't have time to determine the question we did answer. But at least we'll report the five consensus statements of Task Group II.

First, the responsible questioning of authority is important in a democractic society. But an ordered society is essential to true and lasting progress. Second, in listing and defining the types of education that citizens might need, our discussion turned to whether a citizen should be well informed from a technological standpoint or whether that was really important. So my paraphrase of this discussion is that although "gut" and intuitive decisions are important and often correct, the educational system should provide as broad a background as possible for its students so that they as citizens may make responsible and informed choices among alternatives. But it would appear that citizens do not in reality make decisions, as was implied above, but they actually make choices among an array of alternatives which are presented to them. Third, that a basic function of an educational system at any level is to train a person to think or to reason. Perhaps if that goal was attained then we would be able to deal effectively with the other problems which loom ahead. Education is made up of both formal and informal experiences. The formal or classroom component must be designed to recognize and to incorporate the interaction of this continuous lifelong educational process which goes on. To reiterate what was said before by another task force chairman, we must make our classroom experience relevant to the life situation.

Finally we had quite a long discussion which came down to just a short sentence. The major problem faced by education today is that we don't have faith in our teachers. And I think we can say that this is not endemic to any particular level of education, but it is true of all education, from elementary through higher education. As

chairman, I suggested this morning that maybe we should develop a model of an ideal educational system and all its component parts, making absolutely sure that the concept would include both the formal and the informal educational systems. There was some agreement within our task force that certainly there were many aspects to the educational system and that if we attempted to narrowly define education or educational problems, we were overlooking many important facets of the problem. Everyone agreed that education should be as broad based as possible.

Again, we as a group came up with a few specific answers to unasked questions. First, (and I believe this is quite significant), we concluded that we must educate people for a time of change. That of course is a cliche in itself. But we followed that with a positive recommendation that to do this we must develop within the student and teacher alike an inner sense of security. And to do this we must give each person some thing in which he can excell. In other words everyone needs positive reinforcement. The big task facing society, then, is providing an education which will give a sense of security, a sense of self-confidence in our modern, technological post-industrial society. Finally, and probably most importantly, we need to ask ourselves what is important in our total educational effort. If we are concerned with students developing a sense of personal worth, then the teachers in all disciplines and at all levels of the institution of education, academic and non-academic, must exhibit this sense of personal worth. But society has to agree that this is important and perhaps on a par with the usual academic courses and the pursuit of knowledge per se.

In our Task Force we concluded that teachers, students and community leaders alike have numerous hang-ups which color their educational perspective and affect the nature of their concern for the goals of education. One of the serious hang-ups is that people in this modern technological society have a great sense of frustration and failure. Therefore throughout our educational system our absolute standards of measurement tend to place the emphasis on the negative, on failure, rather than success. It was stated by one of the members of our task force that if a person makes 75 per cent on a

test that means he has failed to grasp 25 per cent of the problems. And if a person graduates with a 3.9 grade point average he is made aware of the fact that he has **failed** to reach perfection. What we really need, however, is a positive reinforcement system. We need to place greater emphasis on some form or reward, some form of payoff that will permeate our total society, and probably less stress on failure to achieve certain arbitrary goals.

Task Group III – *Emil Steinhardt**

One thing that was quite evident from our discussion was that we weren't very much in sympathy with the system in which task forces were assigned specific questions and problems to resolve. Sometime this morning, after we had talked around two or three or four hours, we decided that we couldn't or wouldn't answer any of the questions that were posed to us. Therefore, I don't know whether this report will have any significance for the purpose of this meeting or not. One thing was very significant though, in our discussions, and that was the fact that we very seldom mentioned technology in our discussions. Now what significance this might have I will let you decide. We seemed to center our discussions more on education per se and not any particular kind or level of education. If there was one thing on which there was rather unanimous agreement, I suppose one could point to the fact that we weren't very sympathetic with the two track educational system—the vocational track and the academic track. Our group seemed to feel that if we had a comprehensive educational system it ought to be just one track. We felt that if there was a need for a terminal education or a professional track or a technical nature, then it ought to be an implied second track rather than a specific one. Now it should be noted here that these are merely suggestions. We cannot tell you at this time how to carry out and implement these suggestions. No really specific recommendations resulted from our discussions, but we did come up with five things which you might consider pre-recommendations. The consenus of our task force group was that

*Associate Professor of Mechanical Engineering, West Virginia University.

where this implied second track was a part of the educational program, it should be upgraded to where it becomes an integral part of the total learning environment or experience. I guess this is just another way of saying that we really did not like the idea of a second track and therefore we were insisting that if it were to happen we wanted it to be a total learning package. Recognizing the fact that technology will create new service jobs and will provide many opportunities for social service occupations, our group pointed out the need for the second track to take into consideration these service occupations and to provide a meaningful educational experience for those persons entering these occupations. This seems to imply that something should be done to make these occupations socially and economically acceptable and to remove the stigma attached to employment in these industries or occupations and the people going into them. Public Service occupations offer an opportunity to employ many poor persons. But our educational system must prepare the poor for these jobs. Third, we must face up to the necessity of getting away from the idea that educational programs have to be rigidly structured and terminated at a predetermined time. We must somehow get across the idea to society in general and the educational profession in particular that education is going to have to be a life-time endeavor and not ended after eight, ten, twelve or twenty years. I believe this is in line with some of the recommendations that have been made before. Although we didn't say it specifically in that way, the smorgasbord education model or approach might well have some value. As I have said, although we didn't discuss it in that manner, we did conclude that everybody ought to realize that education will have to be a continuing thing and that there must be no stigma attached to dropping out and dropping in at a particular time. Only declining to drop back in would imply failure. The important thing is, we must make and keep education a continuing process for everyone. We also felt that in this second track some kind of feature must be built into the educational system which would encourage people to become actively involved in community life and community affairs. It is in this area that people who perhaps do not have the potential to achieve recognition and

fulfillment otherwise are able to achieve recognition and fulfillment in life. One of the members of our task force made the observation that in her home town a washer woman was probably one of the most influential persons in the town; when there were important decisions to be made the people went to her. And yet by formal training, credentials and standard measurements of ability she is not the logical one to perform this function. Yet she is doing it. We should incorporate something like this into our educational system. Finally, if I synthesized our discussions correctly we probably emphasized a method of instruction rather than any specific system of education. We felt that the method was much more important—how the material is handled, how the students became involved in the learning process. This, we deemed much more important than the content. We went from here to a discussion of the intrinsic values that are indirect benefits or informal values that you get out of education that you really don't plan for. We thought that these were sometimes as important and often more important than most of those planned through the formal structuring of the educational programs. This led some of us to conclude that perhaps the old one-room school wasn't so bad after all, and that maybe if we returned to it West Virginia might well be "one up" on everybody else.

SUMMARY OF CONFERENCE

Alice Mary Hilton*

Edited by Wil J. Smith

I am overwhelmed with all the work that was done by the task groups. In my summary I will not be redundant and merely repeat what you have just heard; I plan to focus on some of the salient points resulting from the task force groups discussions. If I include more of my opinion than is wanted, I ask your indulgence in advance. Also, as a mathematician I am inclined to feel that generalization is desirable so I will try to stress certain points that were stated frequently even if I alter them a little bit.

There are four major categories that we are grappling with. First, we are trying to see **what is.** Secondly, we are trying to visualize **what can be.** Thirdly, we are looking at **obstacles in the way to what can be**—oh, let us call it **our "hang-ups,"** since you have to be with it. And fourthly, we really wouldn't accomplish very much except some very pleasant conversation if we did not ask ourselves **how we can overcome these obstacles.** The crucial question is, how can we deal effectively with our hang-ups so that we can move from what **is** to what **can be**. That is an enormous task and nobody could sensibly expect this group to be 100 per cent, 50 per cent, even 1 per cent successful in two days in accomplishing this task. Nevertheless, I think we made a start. Let's look at this.

First, I feel no one would deny the existence of technology and accelerating change. Both exist, both are complex, one interacts with the other, each feeds the other. They are interdependent. Technology is really nothing new. It began with the first human beings who found they could survive better if they hurled a rock than if they grappled with the animals with their bare hands. The rock was a

*President, Institute for Cybercultural Research, New York City.

tool and they employed it effectively to secure their meat. The only difference between the rock and modern tools (an important difference I grant you) is a matter of degree. Obviously change always has been, always will be, otherwise we would still be cave dwellers. What is so startling and often so traumatic to many of us is the accelerated rate of change. The very acceleration, the seemingly uncontrolled acceleration of change is, it seems to me, the root of our problems.

Returning to a consideration of technology as "things" in very broad terms, I suggest that there are three stages that humans have been going through in the development and evolvement of technology as a tool.

First, I would define technology or the history of technology as the story of man's search for labor-saving devices. The greatest progress in the world has been made by the lazy ones. Many years ago when people were too lazy to drag objects up a hill the wheel was invented. It is the search for labor-saving devices that we are concerned with. Labor-saving devices are machines. Other labor-saving devices people have invented are tools. The differences between tools and machines are found in their uses, primarily, and not in their shapes. A machine is something that supplements or supplants human muscle power. A tool is something whose major function is to augment dexterity. Then we also have output devices and input devices which augment human senses, i.e., the instruments we designed.

These devices that man has invented are the tools of technology. I don't believe that they **are** technology. I agree with what has been said several times. Technology is not just tools, or systems of tools, but a way of organization, a way of thinking, and a way of generally organizing the life of a society.

Originally, it seems to me, man was his own machine. This situation existed for a very long time. All the accomplishments of man until about the 11th or 12th Century were by human muscle power. Human muscle power built the Roman Aqueducts. Human muscle power built the Gothic Cathedrals. It wasn't until the 11th or 12th Century when windmills and water wheels were introduced to

Europe that there was any significant change. Secondly, about the same time, perhaps a century later, another device, a usable horse collar, was invented that made animal power a significant source of energy. Until then horses were used only to carry man. They were very good for running and particularly for war, but they were not work animals.

We had a new stage with the involvement of technology when man used energy sources other than his own muscle power. Man became no longer his own machine, but the attendant of his machines. As we became more sophisticated in using natural resources, the power of the wind, the water, electricity, and atomic energy, we also had to become more sophisticated in developing devices to control these machines.

Not until about twenty years ago did we come up with a device that could take the place of human control action, the computing machine. So we now have entered into a new era of technology, where man is no longer his own machine, where man is no longer needed or will be increasingly less essential as an attendant to his machine where man will become emancipated from his machine, at least as far as its operation is concerned. Now this is an era of transition and transition is always a very difficult problem to deal with. These two questions or points I think we would agree on: "what is technology and what is change?" Now let's turn to what can be.

If we look at this very carefully I think we can boil it right down to something that we all learned in our early civics class, to wit, the rights of life, liberty and the pursuit of happiness. A very broad concept. Just how much these rights mean to you depends very much on your social-technological-economic status, your plane of living. There is little new in this concept, to be sure. The only thing that may be new is that we might achieve this goal more efficiently and more broadly for more people as time goes on, if we are able to handle this transition period. But if we handle ourselves well, then the fruits of technology will enable us to bring the good life to more people more quickly. But if we don't we won't progress very far and we might even retrogress.

I believe the way to achieve this right to life, liberty, and the pursuit of happiness is by a certain measure of leisure and abundance in the life of the individual. Certainly we can see the evidence of increasing prosperity. But there is not real abundance simply because there is still widespread poverty in the world and even in the United States. Of course, leisure is increasing, although it is very unevenly distributed among occupations and income groups and very hard to define. In fact I think that the status symbol of the upper classes, if you like, used to be increasing leisure. The gentleman of leisure was the image of the past. Now, the status symbol is the executive who rushes from one plane to another. But I think these are symbols that really are not very important. The truth is that the vast majority of us do not have to work as hard as we did in the past. Now that our obstacles or hang-ups can shatter this, is the beautiful picture of continuing progress and the lovely vision of the future with life, liberty, and the pursuit of happiness within everyone's grasp? What can happen to keep us from realizing the rosy future?

First, there is the ever-present fear of complete extinction through nuclear war and the less dramatic but I think at this point more dangerous spectre of what is usually called CBW, chemical and biological warfare. This is the overriding danger, because if we are going to blow ourselves off the earth then we really don't have to worry about the shape of education in a technological society.

Secondly, an obstacle to our pursuit of life, liberty, and the pursuit of happiness is the increasing pollution of our air, our water, and our land.

Thirdly, the obstacle of hunger and over-population forcing the decay of our cities and the demoralization of the people and the disintegration of human values. When you talk about human values you always feel a little bit apologetic, as if you were very naive and simply indulging in a pleasant intellectual exercise that is not very relevant to classical reality. So probably these obstacles or hang-ups—and I'm sure we can all think of several more—are the practical subjects for consideration at this time. If we do not resolve these problems soon, we probably never will. I feel strongly that one of the obligations of an educator is to make his students aware of these

problems and to give hope that man can resolve these problems if he makes the complete commitment.

I would now like to consider how we can overcome our troubles. "We shall overcome" is no longer a very fashionable expression, assuming that we can. I think that this generation has two paths (and I'm defining this generation very broadly to include not only the students and teachers but all citizens as human beings). First, we must recognize that the millenium is not just going to happen. Utopia is not just around the corner and it is not going to occur if we just go on with business as usual. We must become accustomed to the idea that we must strive for perfection. But we must also feel that we have accomplished something if we take only a small step toward perfection. Therefore the two specific tasks in our generation are first to carry on a holding action. Let's try to keep our cities from falling apart. Let's try (I think this is a very, very important item in spite of all the difficulties and all the problems we see) to keep some faith in human decency and in civilized behavior, in the ability of human beings to solve the problems that they have created. I think that is probably going to take all the energy any generation can be expected to muster and more wisdom than we see around us at the present time. In practical terms there must be a political rennaisance and a reorganization of those institutions that no longer are responsive to human needs. Moreover, all this must be accomplished in a relatively short time period.

And yet, that is not enough. Certainly we must not blow up the world or drown in a sea of population or smother in a polluted atmosphere. But these are all negative statements. We must simultaneously do something to prepare those who will follow. We must educate them to enable them to take over the enormous building task which we, hopefully, will have begun. All we can do is keep the lands cleared. However we must prepare them for rebuilding society and that means, of course, educating them. Educating them for the world so that they will build and design. But we will have to give them some guidelines. We can keep some ideals alive in them so they will not be satisfied to build a shack but think in terms of building a cathedral.

Now how would you prepare the youth so that they will be the world-builders and problem-solvers of tomorrow, able to right those things we have done wrong and improve those things we have done right? One cannot expect all the answers to be forthcoming from a two-day conference on education. However, I do feel that certain trends can be discerned and there are certain things that everybody seems to be reasonably agreed on.

First, (to be negative again), we don't really believe our educational system is doing a very good job. We feel changes are indicated and when these changes do not take place we feel a sense of frustration. Many of us are in education to initiate and facilitate the change process. The slowness of change and the resistance to change is difficult to tolerate. But the dedicated educator has often been frustrated for he has seldom fully achieved what he really would like. And here I must say again, let us be perfectionists in our aims but not in our expectations. In other words, let us realize that perfection is a long way off; that the only way to come close to perfection is by taking the tiny steps that we are capable of taking during our lifetime.

I think one of the more positive recommendations that was made resulted from a consensus of all three task forces. All seem to agree that in teaching values we must consider social objectives and that one of our social objectives should be, (and I like this statement very much), more concern with education than with certification. We must give people an opportunity to correct their mistakes. Our whole Western Civilization after all is built on the basic principle of forgiveness and redemption. If we can't recognize this, if we can't believe in this in our schools, then there is probably very little hope for us.

Now there are other things that we must do. We must incorporate such values into our textbooks and into our curriculum. We must make (general) education available from cradle to grave. And our educational programs must be designed to permit increased interaction, and what is taught must be relevant (and I am not entirely sure what that word means) to the students. This whole area of relevance is very important, because I think that "relevant" means

not only being relevant to **what is** but also relevant **to what ought to be** or **what we would like** to see happen. Otherwise we are only perpetuating the evils and the errors that we have to contend with now.

So in essence we must have faith in our teachers so that the teachers can radiate self-confidence and transmit this self-confidence to their students. It can be a beneficient or a vicious circle, depending on whether the teacher is good or poor. Because, it seems to me, it isn't enough to tell a child to have faith in the teacher. Faith is not something that just happens. It must be earned. And therefore perhaps we ought to see to it that our teachers are well-prepared; that they deserve the faith that we must have in them so that they can do their jobs well. A very difficult, circular problem, I'll admit.

It seems to me that we always come back to this central point: we must educate for change. This means that we must educate a person to think and to reason; we must educate him to have confidence and to deal with change and we must educate him (as well as we can educate him and as well as he can absorb it) to understand the terrible complexities of our society. Now if we are going to educate for complexity and for thinking then we certainly have to broaden the experience of our students. It seems to me that we would be doing them a great disservice if we just added more courses to the curriculum. For there isn't only the relevance to what **is** and to what **ought to be**, but there is also the relevance of interconnection—the relationship of one course to another and to your life. The whole idea of taking different subjects as a course of study is something that should be outdated by now and perhaps one day will be. Instead, the content subjects or courses will be made relevant to one another.

I think that many of us will admit that it was only as we grew much older that we realized that there was some connection between two subjects that were taught us at different periods of our lives. I remember when I was in high school I once had what I (at that time) thought an absolutely astounding, fantastic idea that geometry, which I had had two years before, and algebra, which I was grappling

with at that time, were really just two different symbolizations with the same basic concepts.

Well, first of all, I think this is not an idea that the high school student should be expected to stumble upon, but this (the relevance or relationship of one course to another) should be the basis of teaching anything. It's not important that you take one course in your sophomore year and one course in your senior year. Obviously we must have some sequence in offering courses; these are the facts of life. But courses or subjects are related and it is critically important that these relationships be stressed. Not only did I have to stumble on this, (and I would not imagine my experience to be atypical), but as soon as I could I told my math professor about this astounding discovery and expected to be called the course genius; the only response I got was: "Did you prepare for your test tomorrow?" That was a pretty crushing experience which I haven't forgotten in more years than I am willing to admit. In fact it was so crushing to me that I concluded that I was not cut out to be a mathematician as I had thought before. I did all my undergraduate work in comparative literature. And in the course of reading the classics I found out that I did not have such a new idea after all. Furthermore it wasn't such a dumb idea. That's when I returned to math.

I'm wondering how many people are discouraged from a very creative pursuit of ideas as a career, if you wish, although I think that the pursuit of ideas for the sake of pursuing ideas is far more important than for the sake of a career. But that is another subject. But I wonder how many children are discouraged from a very fruitful line of thought just because we do not sufficiently stress the relevance, the interconnectedness of areas of instruction.

CONFERENCE ANALYSIS

Wil J. Smith*

I would first like to deal with what I perceive to be some of the critical issues expressed or implied by the principal speakers and the various task forces during this conference, and then later in conclusion give a brief summary of what I view as the principal theme of this conference.

How can we effectively meet the challenges, the problems and the opportunities presented by technological society while at the same time not seriously constraining the individual or at the same time permitting the individual maximum opportunity for individual expression. To put it another way, how do we progress as a nation and maintain and enlarge total freedom while maximizing social returns and benefits from individual differences. This seems to me to be one of the critical issues as well as one of the often implied and often expressed themes of this conference. I think Dr. Lowen in certain comments during his presentation dealt explicitly and implicitly with this point.

Another issue which seemed to loom quite prominently during this conference was that technology gives rise to and creates institutions, values and jobs, while at the same time, somewhat paradoxically, unleashing or setting in motion at least, forces to destroy these institutions, these values, and these jobs. Technology thrusts upon education new and different roles. Many of these are roles which education and educators are unprepared to play and/or reluctant to accept.

Educators or educational institutions have had their greatest success in providing scientific, specialized and quantitative information and assistance to the people. For example, consider the

*Assistant Research Professor of Economics, Office of Research and Development, Appalachian Center, West Virginia University.

agricultural extension program. The experience with the agricultural extension model has been considerably more successful than the experience with the more recent urban-oriented model. Of course the agricultural extension program is much older. But there has been much difficulty in making the transition from a rural or agriculturally-oriented type of program to one that is urban oriented. I think the reasons for this transition difficulty are well known. The agricultural extension program was primarily concerned with the development, dispersion and interpretation of scientific information, much of which concerned the production and distribution of farm products. On the other hand the new extension program is concerned more with human needs and activities.

Dr. Schmandt pointed out that our system of government is based on a philosphy of gradualism. At least it was implied that democracy is to some degree (and in some ways, maybe this is good) a system of government based on gradualism, while technology demands a more immediate and more certain response to problems. Now technology and the technological revolution is closely related to the economic revolution. The technological revolution has given rise to what is known as an affluent society in the United States. But has technology warped or seriously damaged our value system? Technological breakthroughs have been in the area of greater production of goods with the accompanying praise of the merits of a materialistic society and material goods. Perhaps one can say that has warped our values. John Stuart Mill, an economicst and philosopher, believed and hoped that technology would lead to a more blissful state, a stationary state where people would no longer be overly preoccupied with the pursuit of production, more and more goods, and mere existence. But has technology really done this?

Well, I really don't think so, and if it hasn't, why? It would seem because, **technology** is (to a great extent) ideas. And the technological revolution is an idea explosion. Hardware (to a large degree) is a result of technology. While our ideas are futuristically oriented, institutions and hardware are more or less presently-oriented leading to the construction of defensive mechanisms which technology then begins to encounter and tear down.

But it may be asked: Should institutions change as rapidly as technology?

It seems rather inevitable that the pressures and the forces of time and technology will ultimately triumph. But in the meantime many people will suffer in the transition or suffer from the slowness of these institutional changes. For instance I think we can look at two examples. One is the welfare residency law which was recently before the U.S. Supreme Court. A lot of people suffered from this particular institutional constraint when they moved from a state like West Virginia to New York or to other states where they had a waiting period of several months. In most places it was a year before a family could become eligible for public welfare benefits. These residency laws were recently declared unconstitutional and I believe the decision was a good one. Moreover, I would say this court action was a result of technological developments. One can explain it by noting that we are a far more mobile society. Since we can move from state to state very rapidly the Supreme Court recognized the unconstitutionality of restrictions on the travel and mobility of any U.S. citizen.

Another example would be the one we are considering today which is the residency restrictions or stipulations for Presidential elections. These are now being considered by the Supreme Court. No doubt this barrier to a more democratic society will be torn down also.

Another point that seemed to be made during the conference was can (or should) man become master of his technology? To date it is evident that in many instances we have not controlled technology. Also, if we should control it, who should determine the nature of that control and the rate of technological change?

Certainly people are beginning to demand a more decisive role in decisions which affect their lives. The case of the United Mine Workers of America during the reign of John L. Lewis is illustrative. John L. saw the inevitability of mechanization and the automation of coal mines. Thus, in order to protect at least a small number of miners and in order to bring the "good life" to these people and also to permit coal to remain a competitive fuel he permitted, endorsed,

and encouraged the mechanization of the coal mines. I don't think the miner had too much to say about it at that time.

But now let's look at another illustration, the black-lung movement. From the very beginning the rank and file members have been vitally concerned and involved in the movement, including drafting the legislation. And it will be technology which provides some type of answer to this problem by protecting the miner through safety devices and through various health practices that try to control the disease. So the people are demanding more of a role in their present life and in shaping their future.

In education where can society begin to meet the challenges and grasp the opportunities of technology? Certainly it would seem that it is at the elementary and secondary levels that the challenge is greater. At the elementary levels it would appear that there are more people who are more impressionable and more flexible. But are they really? Research studies have pointed up the difficulties of making any type of impact and extending and making permanent this impact on the lives of the children even at this early age. Other researchers are saying that prenatal care (i.e., good nutrition) is the all important time to reach the child. It has been demonstrated that in the lower income groups nutrition problems can permanently damage the brain cells of the individual. Technology may have few answers here. For those children born and reared in homes where poor nutritional habits exist, the best teachers and the best facilities may be less than a satisfactory answer.

Finally, what about the role of technology in minimizing the gap between the haves and have nots? To date the "good life" has not been attained by many of the upper income groups (at least all of the "good life"), and less, rather than greater, equality of opportunity is the reality for so many of the poor in the United States. Technology has permitted a number of people to become very wealthy and enabled them to hire lawyers to help them escape their rightful tax burden. This has added to and, I think, widened the gap between the haves and have nots. Today, thanks to certain technological breakthroughs, the risks involved in drilling oil wells has been substantially reduced. Yet we have retained the oil

depletion allowance–which was established in part of compensate for the risks and losses incurred in the search for oil–at rates only slightly lower than previously. It would seem, then, that technology has (in some ways at least) acted to widen rather than narrow the gap between the haves and have nots.

Finally, in the educational area the real issue and also the real paradox is how to achieve the most desirable balance (one with roots in the future) between specialized and general or liberal arts education. In other words we must make education relevant to today's needs but still maintain its futuristic outlook. Does education really have a role in providing occupationally oriented students for society and the nation's industries? Coming back to a point that Dr. Lowen made rather clearly, if I interpret him properly, we must create a multi-dimensional system which is aware of and maximizes individual abilities and utilizes all senses, tactile as well as mental. These senses must not only be utilized but stimulated.

To date is is apparent that we have been a nation of people acting only after seeing, rather than hearing what people have been saying. The riots, the burnings of the cities and the multitude of difficulties in the urban areas are exemplary. We were told about this and social researchers had been warning of the explosion for many years. But we had to view the destruction before we would act. So to a degree (to use an old cliche) many of us seem to be from Missouri.

Dr. DeSimone stated that the democratic society of the United States was in a sense a crisis-ridden and a crisis-driven society. American society seems to operate from one crisis to another. This appears to be true not only in the defense area but also in the domestic area, if one studies the urban crisis, the poverty and the hunger problems. We certainly operate on the basis in the international sphere. To me it seems self-evident that a crisis-run society has a high probability of being a badly run society. At most it is a society operating at less than maximum efficiency with a multitude of undesirable effects for society. Much of our tax policies, I would say, are a result of this type of policy. Examples of this are the 10

per cent surtax and many other of our taxes that have been incorporated into our system as war taxes. I feel we must overcome this tendency, if the benefits of technology are to be distributed more equally to all socio-economic groups.

In summary, what has been the central issue and central theme of this conference? The following points can be made. The goal and the role of education in almost any type of society, but especially in a technological society, should be, in the words of Dr. Robert Hutchins, "to put the individual in maximum control of all his faculties and to develop his faculties to the highest possible level." Put in another way, (as Dr. Lowen would say) the role and the goal of education is to make fully and maxi-operational the senses of each individual. What plan or model to adopt to assure the successful education of each individual and all people in a technological society is a matter of some controversy and deep concern, as I think this conference has well illustrated, if my task force was any way representative. It would appear that the models would be as varied as the backgrounds, experiences and disciplines of their proponents and creators. But it would seem that any model, any program, any educational process would incorporate (and perhaps should and must incorporate) a high degree of experimentation, trial and error, hit and miss and to some degree inefficient stops and starts, directions and redirections.

If we say that we must be cognizant of and responsive to individual differences; if we constantly strive to avoid molding the individual to our own sterotypes and perhaps our highly imperfect and even erroneous views of what society demands, and what the individual requires for his greatest happiness and success in the short-run and the long-run, then individual treatment and perhaps individual counselling must become a prerequisite of any educational system in a technological society.

In short, one must be wary of the easy way, the practical way, the general all-inclusive model. Education is a long-term process. Its direct payoffs are, given the present state of the arts, difficult to measure when one recognizes the multitudes of direct and indirect

individual and social benefits. Although the benefits of education are sometimes slow in materializing they are certain.

The educational process admittedly might well be inefficient and unproductive measured in terms of a fast-paced, goods-conscious, materialistic society. But if there is one area in which inefficiencies and diseconomies perhaps can be tolerated or at least understood and maybe even expected, it's in education. The growth and very existence of a democratic, social welfare society with the necessary ingredients of humanism demands nothing less than the distribution of the benefits of education to all social and economic levels.

Technology seems to thrust upon everyone, every institution, new challenges and new opportunities. But it would appear that the educational institutions have felt the greatest brunt of the problems and the opportunities. Perhaps because in no other place in our society are groups of people brought together that are so vitally and constantly concerned with and actually seeking answers to all of society's problems. Therefore, the frustrations and the joys of small successes in dealing with technological society is concentrated there. In this conference and perhaps in our task force no answers or at least no dramatically new answers were discovered. But in rehashing and resifting the old, perhaps a new grain of truth was discovered or at least an old truth rediscovered.

APPENDICES

APPENDIX A

WEST VIRGINIA UNIVERSITY
CONFERENCE ON
EDUCATION IN A TECHNOLOGICAL SOCIETY

May 4, 5 and 6, 1969

Mont Chateau Conference Center
Morgantown, West Virginia

Sponsored by: The Appalachian Center and the College of Human Resources and Education, West Virginia University

Sunday, May 4, 1969

8:00–8:20 p.m. SESSION I
Chairman: Jay Barton II, Provost for Instruction, West Virginia University
Conference Orientation
1. Introductions–Paul W. DeVore, Professor
Division of Education, West Virginia University
2. Conference Purpose–B. L. Coffindaffer, Director,
Office of Federal-State Relations, Office of the Governor,
State of West Virginia

8:20-9:15 p.m. Keynote Address
"Technology and Social Purpose"–Juergen Schmandt, Associate Director, Program on Technology and Society, Harvard University

9:15-9:45 p.m. Educational Implications–General Discussion
Discussion Leader: Carl Frasure, Dean, College of Arts and Sciences, West Virginia University

Monday, May 5, 1969

9:00-9:45 a.m. SESSION II
Chairman: Alice Mary Hilton, President, Institute for Cybercultural Research
"The Future of Man in a Technological Society"–James H. Straubel, Executive Secretary, Aerospace Education Foundation, Washington, D.C.

9:45-10:30 a.m. Educational Implications–General Discussion
Discussion Leader: Paul L. Selby, Dean, College of Law, West Virginia University

10:45-11:30 a.m. SESSION III
Chairman: Alice Mary Hilton
"Technology and Change: Educational Imperatives"–Daniel V. DeSimone, Director, Office of Invention and Innovation, National Bureau of Standards, Washington, D.C.

11:30-12:00 noon Educational Implications–General Discussions
Discussion Leader: Stanley O. Ikenberry, Dean, College of Human Resources and Education, West Virginia University

1:30-2:15 p.m. SESSION IV
Chairman: Alice Mary Hilton
"Technology, Education and Society"–Walter Lowen, Dean, School of Advanced Technology, State University of New York, Binghampton

2:45-4:30 p.m. SESSION V
Chairman: Paul W. DeVore
Task Group Seminars
Task Group 1 – Raymond M. Haas, Chairman
Task Group 2 – George Weaver, Chairman
Task Group 3 – Emil Steinhardt, Chairman

8:00–8:45 p.m. SESSION VI
Chairman: Alice Mary Hilton
"Education, Technology and Human Values"–Edward Layton, Professor, Division of Special Interdisciplinary Studies, Case Western Reserve University, Cleveland

8:45-9:45 p.m. Educational Implications – General Discussion
Discussion Leader: Quintus C. Wilson, Dean, School of Journalism, West Virginia University

Tuesday, May 6, 1969

8:30-10:30 a.m. SESSION VII
Chairman: Paul W. DeVore
Task Group Seminars
Task Group 1 – Raymond M. Haas, Chairman
Task Group 2 – George Weaver, Chairman
Task Group 3 – Emil Steinhardt, Chairman

10:45-11:45 a.m. SESSION VIII
Chairman: Alice Mary Hilton
General Session – Task Group Reports
A. Education in a Technological Society
The Public Schools
B. Education in a Technological Society
Higher Education

11:45-12:15 p.m. SESSION IX
Chairman: Alice Mary Hilton
General Session

12:15-12:30 p.m. Conference Analysis – Wil J. Smith, Assistant Research Professor of Economics, Office of Research and Development, Appalachian Center, West Virginia University

12:30-12:45 p.m. Concluding Remarks – Jay Barton II

APPENDIX B

TASK GROUP ASSIGNMENTS

Task Group I

Raymond Haas, Chairman
Daniel DeSimone
Quintus Wilson
Stanley O. Ikenberry
Michael Wilson
Ernest Vargas
Roman Aquizap
Peter Wholley
Virgil Peterson
Everett Carter
Harold Halfin
Lawrence Derthick
Franklin Parker
Cyril W. Johnson
Roger Cantor
John Stasny*
Frederick J. Wegmann

Task Group II

Chester Arents, Chairman
George Weaver
Walter Lowen
Carl Frasure
Edward Layton
Charles Jenkins
William Katz*
Michael Tseng
George Kirk
Willard D. Lorenson
Eugene Staples
Delmas Miller
Clarence Heyel
James H. Straubel
Alice Mary Hilton
B. L. Coffindaffer
Herbert G. Wilcox

Task Group III

Emil Steinhardt, Chairman
Juergen Schmandt
Paul Selby
E. Thomas Miller
Helen Plants
Harold Goodwin*
Ernest J. Nesius
Wil J. Smith
Michael Gates
John Loth
Thomas J. Brennan
Dwight A. Fowler
Ted White
Joseph B. Moriarty
William Alexander
Senator William Moreland
Delegate Clifford Hoard
Paul Manchak
Phillip D. Stark
Kenneth Clay
Lorita D. Jenab
James O'Hara
Jay Barton II